

Examples: DOLCE and BFO in DL and Manchester syntax

Maria Keet
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1 Disclaimer and background information

This file has been made to serve as an illustration that is used in the Semantic Web Technologies course¹ (code: 72010, year '09/'10, at the Free University of Bozen-Bolzano, Italy) and is *NOT* a reference file for either DOLCE or BFO.

How to read this file

The OWL versions of DOLCE (`DOLCE-lite.owl` from the `DLP3971.zip` file²) and BFO (`bfo-1.1.owl` downloaded on 13-11-'09³), respectively, have been loaded into Protégé 4.0 build 113, and by using “Save as... latex” exported to a DL rendering, whereas the Manchester syntax has been copied from its “Manchester syntax rendering” view in Protégé. I did not verify if the transformations are correct; so it comes as is. The Manchester syntax rendering is rather lengthy, both due to its layout and that it includes the annotations/comments that provide explanation of the intended meaning of the categories.

To make the connection between these two renderings and the Protégé interface a little clearer, take, for instance, DOLCE’s *physical-quality*, depicted in Fig. 1 on the next page, or BFO’s *quality* (Fig. 2) and check the corresponding representations and annotations in the remainder of this file.

Observe also the difference in OWL features that are used (or not) by DOLCE and BFO: the core BFO in OWL does not use object properties (but check also the *isabelle* version of BFO and there is a `bfo-ro.owl`). Neither one has data properties or individuals.

The annotations have limited information about *synonyms*, e.g. that BFO’s *Continuant* is synonymous with (DOLCE’s) *Endurant*. Can you find more (exact or near-) matches?

Reference information

The essential information about DOLCE can be found in the WonderWeb Deliverable D18 [1] and the DOLCE website at the LOA⁴, where you can notice that “[t]he [owl-ized] “lite” versions are simplified translations of Dolce2.0 that do not consider: modality, temporal indexing, relation composition. In addition, different names are adopted for relations that have the same name but different arities in the FOL version. Some commonsense concepts have also been added as examples.”

For BFO, there are several sources. The BFO website⁵ of IFOMIS directs you to three technical reports and seven publications that deal with, e.g. the issue of core relations [3], ontology as reality representation [2], and the differences between SNAP(shot) and SPAN(ning) to distinguish between the object-view and processual-view.

¹<http://www.meteck.org/SWT.html>

²<http://www.loa-cnr.it/ontologies/DLP3971.zip>

³<http://www.ifomis.org/bfo/1.1>

⁴<http://www.loa-cnr.it/DOLCE.html>

⁵<http://www.ifomis.org/bfo>

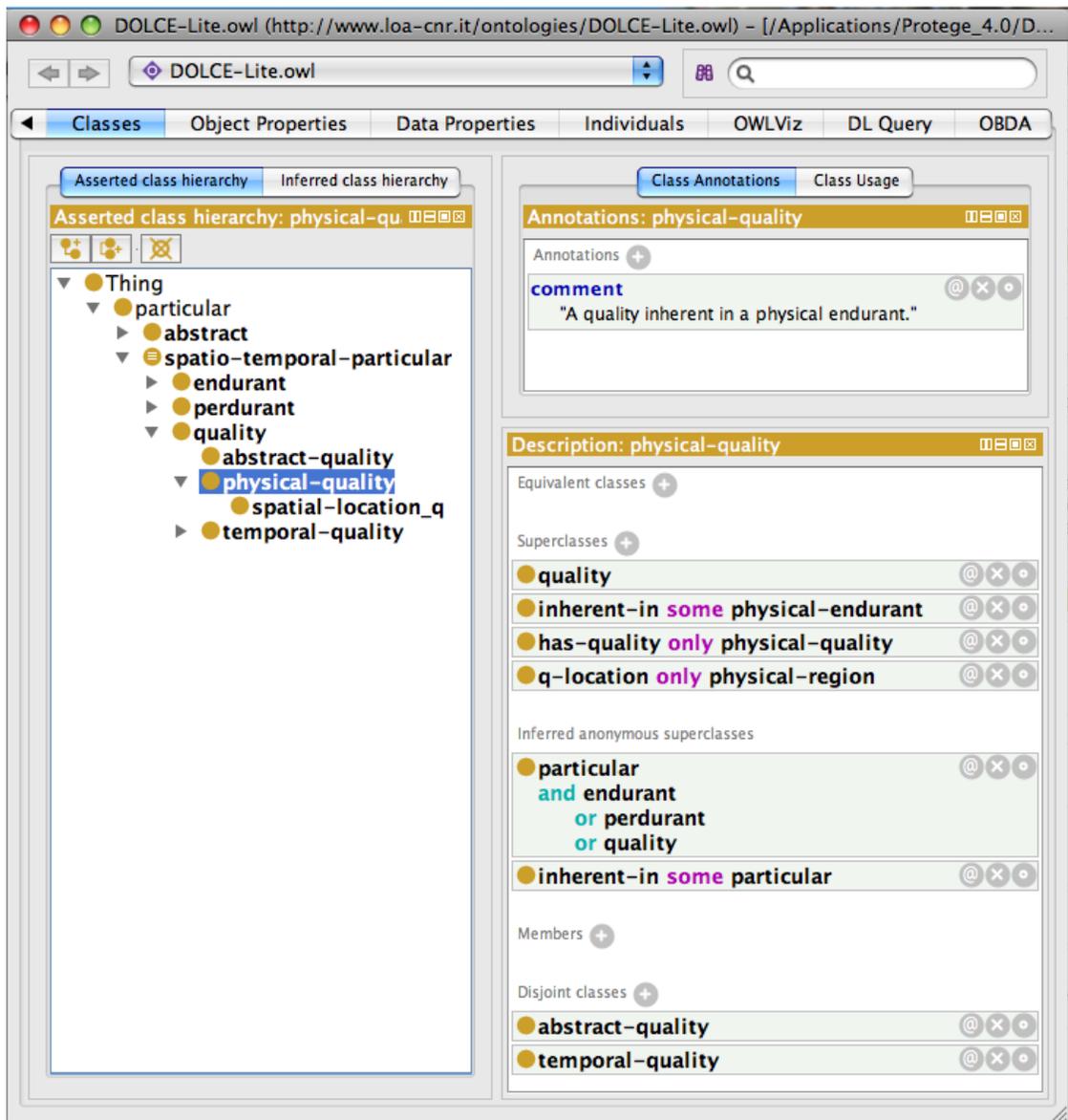


Figure 1: Protégé's interface to DOLCE's *physical-quality*.

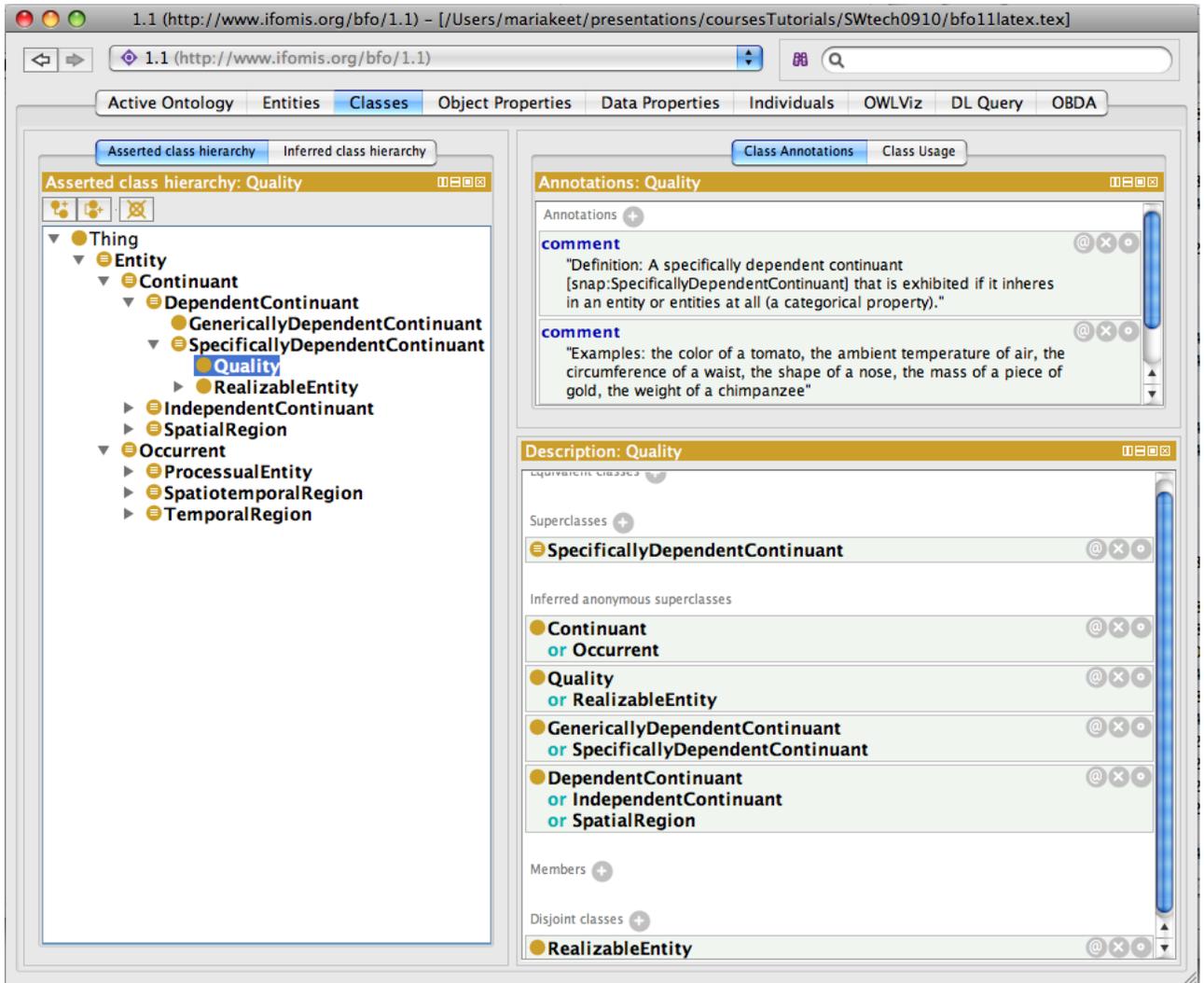


Figure 2: Protégé's interface to BFO's *quality*.

2 DOLCE-Lite in DL

Classes

abstract $\sqsubseteq \forall \text{has-quality}.\neg\text{temporal-location}_q$
abstract $\sqsubseteq \text{particular}$
abstract $\sqsubseteq \forall \text{has-quality}.\neg\text{spatial-location}_q$
abstract $\sqsubseteq \neg\text{perdurant}$
abstract $\sqsubseteq \neg\text{quality}$
abstract $\sqsubseteq \neg\text{endurant}$
abstract-quality $\sqsubseteq \forall q\text{-location}.\text{abstract-region}$
abstract-quality $\sqsubseteq \forall \text{has-quality}.\text{abstract-quality}$
abstract-quality $\sqsubseteq \exists \text{inherent-in}.\text{non-physical-endurant}$
abstract-quality $\sqsubseteq \text{quality}$
abstract-quality $\sqsubseteq \neg\text{temporal-quality}$
abstract-quality $\sqsubseteq \neg\text{physical-quality}$
abstract-region $\sqsubseteq \forall q\text{-location-of}.\text{abstract-quality}$
abstract-region $\sqsubseteq \forall \text{part}.\text{abstract-region}$
abstract-region $\sqsubseteq \text{region}$
abstract-region $\sqsubseteq \neg\text{physical-region}$
abstract-region $\sqsubseteq \neg\text{temporal-region}$
accomplishment $\sqsubseteq \text{event}$
achievement $\sqsubseteq \text{event}$
amount-of-matter $\sqsubseteq \text{physical-endurant}$
amount-of-matter $\sqsubseteq \neg\text{feature}$
amount-of-matter $\sqsubseteq \neg\text{physical-object}$
arbitrary-sum $\sqsubseteq \exists \text{part}.\text{endurant}$
arbitrary-sum $\sqsubseteq \text{endurant}$
arbitrary-sum $\sqsubseteq \neg\text{non-physical-endurant}$
arbitrary-sum $\sqsubseteq \neg\text{physical-endurant}$
dependent-place $\sqsubseteq \text{feature}$
endurant $\sqsubseteq \forall \text{specific-constant-constituent}.\text{endurant}$
endurant $\sqsubseteq \text{spatio-temporal-particular}$
endurant $\sqsubseteq \exists \text{participant-in}.\text{perdurant}$
endurant $\sqsubseteq \forall \text{part}.\text{endurant}$
endurant $\sqsubseteq \neg\text{perdurant}$
endurant $\sqsubseteq \neg\text{quality}$
endurant $\sqsubseteq \neg\text{abstract}$
event $\sqsubseteq \text{perdurant}$
feature $\sqsubseteq \text{physical-endurant}$
feature $\sqsubseteq \exists \text{host}.\text{physical-endurant}$
feature $\sqsubseteq \neg\text{amount-of-matter}$
feature $\sqsubseteq \neg\text{physical-object}$
non-physical-endurant $\sqsubseteq \forall \text{has-quality}.\text{abstract-quality}$
non-physical-endurant $\sqsubseteq \forall \text{part}.\text{non-physical-endurant}$
non-physical-endurant $\sqsubseteq \text{endurant}$
non-physical-endurant $\sqsubseteq \neg\text{arbitrary-sum}$
non-physical-endurant $\sqsubseteq \neg\text{physical-endurant}$
non-physical-object $\sqsubseteq \exists \text{generically-dependent-on}.\text{physical-endurant}$
non-physical-object $\sqsubseteq \text{non-physical-endurant}$
non-physical-object $\sqsubseteq \forall \text{part}.\text{non-physical-object}$
perdurant $\sqsubseteq \forall \text{specific-constant-constituent}.\text{perdurant}$
perdurant $\sqsubseteq \exists \text{has-quality}.\text{temporal-location}_q$
perdurant $\sqsubseteq \exists \text{participant}.\text{endurant}$
perdurant $\sqsubseteq \forall \text{has-quality}.\text{temporal-quality}$
perdurant $\sqsubseteq \forall \text{part}.\text{perdurant}$
perdurant $\sqsubseteq \text{spatio-temporal-particular}$

perdurant \sqsubseteq \neg endurant
 perdurant \sqsubseteq \neg quality
 perdurant \sqsubseteq \neg abstract
 physical-endurant \sqsubseteq \forall specific-constant-constituent.physical-endurant
 physical-endurant \sqsubseteq endurant
 physical-endurant \sqsubseteq \forall has-quality.physical-quality
 physical-endurant \sqsubseteq \exists has-quality.spatial-location_q
 physical-endurant \sqsubseteq \forall part.physical-endurant
 physical-endurant \sqsubseteq \exists has-quality.physical-quality
 physical-endurant \sqsubseteq \neg non-physical-endurant
 physical-endurant \sqsubseteq \neg arbitrary-sum
 physical-object \sqsubseteq physical-endurant
 physical-object \sqsubseteq \neg amount-of-matter
 physical-object \sqsubseteq \neg feature
 physical-quality \sqsubseteq quality
 physical-quality \sqsubseteq \exists inherent-in.physical-endurant
 physical-quality \sqsubseteq \forall q-location.physical-region
 physical-quality \sqsubseteq \forall has-quality.physical-quality
 physical-quality \sqsubseteq \neg abstract-quality
 physical-quality \sqsubseteq \neg temporal-quality
 physical-region \sqsubseteq \forall q-location-of.physical-quality
 physical-region \sqsubseteq \forall part.physical-region
 physical-region \sqsubseteq region
 physical-region \sqsubseteq \neg abstract-region
 physical-region \sqsubseteq \neg temporal-region
 process \sqsubseteq stative
 proposition \sqsubseteq abstract
 quale \equiv region \sqcap \exists atomic-part-of.region
 quality \sqsubseteq spatio-temporal-particular
 quality \sqsubseteq \exists inherent-in.particular
 quality \sqsubseteq \neg perdurant
 quality \sqsubseteq \neg abstract
 quality \sqsubseteq \neg endurant
 quality-space \equiv region \sqcap \forall overlaps. \neg quality-space
 region \sqsubseteq \forall part.region
 region \sqsubseteq abstract
 relevant-part \sqsubseteq feature
 set \sqsubseteq abstract
 space-region \sqsubseteq \forall part.space-region
 space-region \sqsubseteq physical-region
 space-region \sqsubseteq \forall q-location-of.spatial-location_q
 spatial-location_q \sqsubseteq physical-quality
 spatio-temporal-particular \equiv particular \sqcap endurant \sqcup perdurant \sqcup quality
 spatio-temporal-region \sqsubseteq space-region
 state \sqsubseteq stative
 stative \sqsubseteq perdurant
 temporal-location_q \sqsubseteq temporal-quality
 temporal-quality \sqsubseteq quality
 temporal-quality \sqsubseteq \forall q-location.temporal-region
 temporal-quality \sqsubseteq \forall has-quality.temporal-quality
 temporal-quality \sqsubseteq \exists inherent-in.perdurant
 temporal-quality \sqsubseteq \neg abstract-quality
 temporal-quality \sqsubseteq \neg physical-quality
 temporal-region \sqsubseteq \forall q-location-of.temporal-quality
 temporal-region \sqsubseteq region
 temporal-region \sqsubseteq \forall part.temporal-region
 temporal-region \sqsubseteq \neg abstract-region

temporal-region \sqsubseteq \neg *physical-region*

time-interval \sqsubseteq *temporal-region*

Object properties

abstract-location \sqsubseteq *exact-location*

abstract – location \equiv *abstract – location – of*⁻

\exists *abstract-location* \sqsubseteq *non-physical-endurant*

\top \sqsubseteq \forall *abstract-location*.*abstract-region*

abstract-location-of \sqsubseteq *exact-location-of*

abstract – location \equiv *abstract – location – of*⁻

\exists *abstract-location-of* \sqsubseteq *abstract-region*

\top \sqsubseteq \forall *abstract-location-of*.*non-physical-endurant*

atomic-part \sqsubseteq *part*

atomic – part \equiv *atomic – part – of*⁻

\exists *atomic-part* \sqsubseteq *particular*

\top \sqsubseteq \forall *atomic-part*.*particular*

atomic-part-of \sqsubseteq *part-of*

atomic – part \equiv *atomic – part – of*⁻

\exists *atomic-part-of* \sqsubseteq *particular*

\top \sqsubseteq \forall *atomic-part-of*.*particular*

boundary \sqsubseteq *proper-part*

boundary \equiv *boundary – of*⁻

\exists *boundary* \sqsubseteq *particular*

\top \sqsubseteq \forall *boundary*.*particular*

boundary-of \sqsubseteq *proper-part-of*

boundary \equiv *boundary – of*⁻

\exists *boundary-of* \sqsubseteq *particular*

\top \sqsubseteq \forall *boundary-of*.*particular*

constant-participant \sqsubseteq *participant*

constant – participant – in \equiv *constant – participant*⁻

\exists *constant-participant* \sqsubseteq *perdurant*

\top \sqsubseteq \forall *constant-participant*.*endurant*

constant-participant-in \sqsubseteq *participant-in*

constant – participant – in \equiv *constant – participant*⁻

\exists *constant-participant-in* \sqsubseteq *endurant*

\top \sqsubseteq \forall *constant-participant-in*.*perdurant*

exact-location \sqsubseteq *generic-location*

exact – location – of \equiv *exact – location*⁻

\exists *exact-location* \sqsubseteq *particular*

\top \sqsubseteq \forall *exact-location*.*region*

exact-location-of \sqsubseteq *generic-location-of*

exact – location – of \equiv *exact – location*⁻

\exists *exact-location-of* \sqsubseteq *region*

\top \sqsubseteq \forall *exact-location-of*.*particular*

generic-constituent \sqsubseteq *immediate-relation*

generic – constituent – of \equiv *generic – constituent*⁻

\exists *generic-constituent* \sqsubseteq *particular*

\top \sqsubseteq \forall *generic-constituent*.*particular*

generic-constituent-of \sqsubseteq *immediate-relation-i*

generic – constituent – of \equiv *generic – constituent*⁻

\exists *generic-constituent-of* \sqsubseteq *particular*

\top \sqsubseteq \forall *generic-constituent-of*.*particular*

generic-dependent \sqsubseteq *immediate-relation*

generic – dependent \equiv *generically – dependent – on*⁻

\exists *generic-dependent* \sqsubseteq *particular*

\top \sqsubseteq \forall *generic-dependent*.*particular*

generic-location \sqsubseteq *mediated-relation*
generic – location \equiv *generic – location – of*⁻
 \exists *generic-location* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *generic-location*.*particular*
generic-location-of \sqsubseteq *mediated-relation-i*
generic – location \equiv *generic – location – of*⁻
 \exists *generic-location-of* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *generic-location-of*.*particular*
generically-dependent-on \sqsubseteq *immediate-relation-i*
generic – dependent \equiv *generically – dependent – on*⁻
 \exists *generically-dependent-on* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *generically-dependent-on*.*particular*
has-quale \sqsubseteq *q-location*
has – quale \equiv *quale – of*⁻
 \exists *has-quale* \sqsubseteq *quality*
 $\top \sqsubseteq \forall$ *has-quale*.*quale*
has-quality \sqsubseteq *immediate-relation-i*
has – quality \equiv *inherent – in*⁻
 \exists *has-quality* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *has-quality*.*quality*
has-t-quality \sqsubseteq *has-quality*
has – t – quality \equiv *t – inherent – in*⁻
 \exists *has-t-quality* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *has-t-quality*.*quality*
host \sqsubseteq *specifically-constantly-dependent-on*
host \equiv *host – of*⁻
 \exists *host* \sqsubseteq *feature*
 $\top \sqsubseteq \forall$ *host*.*physical-endurant*
host-of \sqsubseteq *specific-constant-dependent*
host \equiv *host – of*⁻
 \exists *host-of* \sqsubseteq *physical-endurant*
 $\top \sqsubseteq \forall$ *host-of*.*feature*
identity-c \sqsubseteq *immediate-relation*
identity – c \equiv *identity – c*⁻
identity-c \circ *identity-c* \sqsubseteq *identity-c*
 \exists *identity-c* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *identity-c*.*particular*
identity-n \sqsubseteq *immediate-relation*
identity – n \equiv *identity – n*⁻
identity-n \circ *identity-n* \sqsubseteq *identity-n*
 \exists *identity-n* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *identity-n*.*particular*
immediate – relation – i \equiv *immediate – relation*⁻
 \exists *immediate-relation* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *immediate-relation*.*particular*
immediate – relation – i \equiv *immediate – relation*⁻
 \exists *immediate-relation-i* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *immediate-relation-i*.*particular*
inherent-in \sqsubseteq *immediate-relation*
has – quality \equiv *inherent – in*⁻
 \exists *inherent-in* \sqsubseteq *quality*
 $\top \sqsubseteq \forall$ *inherent-in*.*particular*
life \sqsubseteq *constant-participant-in*
life \equiv *life – of*⁻
 \exists *life* \sqsubseteq *endurant*
 $\top \sqsubseteq \forall$ *life*.*perdurant*
life-of \sqsubseteq *constant-participant*

life \equiv *life - of*⁻
 \exists *life-of* \sqsubseteq *perdurant*
 $\top \sqsubseteq \forall$ *life-of.endurant*
mediated - relation - i \equiv *mediated - relation*⁻
 \exists *mediated-relation* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *mediated-relation.particular*
mediated - relation - i \equiv *mediated - relation*⁻
 \exists *mediated-relation-i* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *mediated-relation-i.particular*
mereologically-coincides \sqsubseteq *temporary-part*
mereologically - coincides \equiv *mereologically - coincides*⁻
 \exists *mereologically-coincides* \sqsubseteq *endurant*
 $\top \sqsubseteq \forall$ *mereologically-coincides.endurant*
overlaps \sqsubseteq *mediated-relation*
overlaps \equiv *overlaps*⁻
 \exists *overlaps* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *overlaps.particular*
part \sqsubseteq *immediate-relation*
part \equiv *part - of*⁻
part \circ *part* \sqsubseteq *part*
 \exists *part* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *part.particular*
part-of \sqsubseteq *immediate-relation-i*
part \equiv *part - of*⁻
part-of \circ *part-of* \sqsubseteq *part-of*
 \exists *part-of* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *part-of.particular*
participant \sqsubseteq *immediate-relation*
participant \equiv *participant - in*⁻
 \exists *participant* \sqsubseteq *perdurant*
 $\top \sqsubseteq \forall$ *participant.endurant*
participant-in \sqsubseteq *immediate-relation-i*
participant \equiv *participant - in*⁻
 \exists *participant-in* \sqsubseteq *endurant*
 $\top \sqsubseteq \forall$ *participant-in.perdurant*
partly-compresent \sqsubseteq *mediated-relation*
partly - compresent \equiv *partly - compresent*⁻
 \exists *partly-compresent* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *partly-compresent.particular*
physical-location \sqsubseteq *exact-location*
physical - location \equiv *physical - location - of*⁻
 \exists *physical-location* \sqsubseteq *physical-endurant*
 $\top \sqsubseteq \forall$ *physical-location.physical-region*
physical-location-of \sqsubseteq *exact-location-of*
physical - location \equiv *physical - location - of*⁻
 \exists *physical-location-of* \sqsubseteq *physical-region*
 $\top \sqsubseteq \forall$ *physical-location-of.physical-endurant*
proper-part \sqsubseteq *part*
proper - part - of \equiv *proper - part*⁻
proper-part \circ *proper-part* \sqsubseteq *proper-part*
 \exists *proper-part* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *proper-part.particular*
proper-part-of \sqsubseteq *part-of*
proper - part - of \equiv *proper - part*⁻
proper-part-of \circ *proper-part-of* \sqsubseteq *proper-part-of*
 \exists *proper-part-of* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *proper-part-of.particular*

$q\text{-location} \sqsubseteq \text{immediate-relation}$
 $q\text{-location} \equiv q\text{-location} - of^-$
 $\exists q\text{-location} \sqsubseteq \text{quality}$
 $\top \sqsubseteq \forall q\text{-location.region}$
 $q\text{-location-of} \sqsubseteq \text{immediate-relation-i}$
 $q\text{-location} \equiv q\text{-location} - of^-$
 $\exists q\text{-location-of} \sqsubseteq \text{region}$
 $\top \sqsubseteq \forall q\text{-location-of.quality}$
 $q\text{-present-at} \sqsubseteq \text{mediated-relation}$
 $time - of - q - presence - of \equiv q - present - at^-$
 $\exists q\text{-present-at} \sqsubseteq \text{physical-quality}$
 $\top \sqsubseteq \forall q\text{-present-at.time-interval}$
 $quale-of \sqsubseteq q\text{-location-of}$
 $has - quale \equiv quale - of^-$
 $\exists quale-of \sqsubseteq \text{quale}$
 $\top \sqsubseteq \forall quale-of.quality$
 $r\text{-location} \sqsubseteq \text{immediate-relation}$
 $r\text{-location} - of \equiv r\text{-location}^-$
 $\exists r\text{-location} \sqsubseteq \text{region}$
 $\top \sqsubseteq \forall r\text{-location.region}$
 $r\text{-location-of} \sqsubseteq \text{immediate-relation-i}$
 $r\text{-location} - of \equiv r\text{-location}^-$
 $\exists r\text{-location-of} \sqsubseteq \text{region}$
 $\top \sqsubseteq \forall r\text{-location-of.region}$
 $sibling-part \sqsubseteq \text{mediated-relation}$
 $sibling - part \equiv sibling - part^-$
 $\exists sibling-part \sqsubseteq \text{particular}$
 $\top \sqsubseteq \forall sibling-part.particular$
 $spatio-temporal-presence-of \sqsubseteq \text{exact-location-of}$
 $spatio - temporal - presence - of \equiv spatio - temporally - present - at^-$
 $\exists spatio-temporal-presence-of \sqsubseteq \text{spatio-temporal-region}$
 $\top \sqsubseteq \forall spatio-temporal-presence-of.particular$
 $spatio-temporally-present-at \sqsubseteq \text{exact-location}$
 $spatio - temporal - presence - of \equiv spatio - temporally - present - at^-$
 $\exists spatio-temporally-present-at \sqsubseteq \text{particular}$
 $\top \sqsubseteq \forall spatio-temporally-present-at.spatio-temporal-region$
 $specific-constant-constituent \sqsubseteq \text{immediate-relation}$
 $specific - constant - constituent \equiv specific - constant - constituent - of^-$
 $\exists specific-constant-constituent \sqsubseteq \text{particular}$
 $\top \sqsubseteq \forall specific-constant-constituent.particular$
 $specific-constant-constituent-of \sqsubseteq \text{immediate-relation-i}$
 $specific - constant - constituent \equiv specific - constant - constituent - of^-$
 $\exists specific-constant-constituent-of \sqsubseteq \text{particular}$
 $\top \sqsubseteq \forall specific-constant-constituent-of.particular$
 $specific-constant-dependent \sqsubseteq \text{immediate-relation}$
 $specifically - constantly - dependent - on \equiv specific - constant - dependent^-$
 $\exists specific-constant-dependent \sqsubseteq \text{particular}$
 $\top \sqsubseteq \forall specific-constant-dependent.particular$
 $specifically-constantly-dependent-on \sqsubseteq \text{immediate-relation-i}$
 $specifically - constantly - dependent - on \equiv specific - constant - dependent^-$
 $\exists specifically-constantly-dependent-on \sqsubseteq \text{particular}$
 $\top \sqsubseteq \forall specifically-constantly-dependent-on.particular$
 $strong-connection \sqsubseteq \text{mediated-relation}$
 $strong - connection \equiv strong - connection^-$
 $\exists strong-connection \sqsubseteq \text{particular}$
 $\top \sqsubseteq \forall strong-connection.particular$
 $t\text{-inherent-in} \sqsubseteq \text{inherent-in}$

has - t - quality \equiv *t - inherent - in*⁻
 \exists *t-inherent-in* \sqsubseteq *quality*
 $\top \sqsubseteq \forall$ *t-inherent-in*.*particular*
temporary-atomic-part \sqsubseteq *temporary-proper-part*
temporary - atomic - part \equiv *temporary - atomic - part - of*⁻
 \exists *temporary-atomic-part* \sqsubseteq *endurant*
 $\top \sqsubseteq \forall$ *temporary-atomic-part*.*endurant*
temporary-atomic-part-of \sqsubseteq *temporary-proper-part-of*
temporary - atomic - part \equiv *temporary - atomic - part - of*⁻
 \exists *temporary-atomic-part-of* \sqsubseteq *endurant*
 $\top \sqsubseteq \forall$ *temporary-atomic-part-of*.*endurant*
temporary-part \sqsubseteq *partly-compresent*
temporary-part \sqsubseteq *part*
temporary - part - of \equiv *temporary - part*⁻
 \exists *temporary-part* \sqsubseteq *endurant*
 $\top \sqsubseteq \forall$ *temporary-part*.*endurant*
temporary-part-of \sqsubseteq *partly-compresent*
temporary-part-of \sqsubseteq *part-of*
temporary - part - of \equiv *temporary - part*⁻
 \exists *temporary-part-of* \sqsubseteq *endurant*
 $\top \sqsubseteq \forall$ *temporary-part-of*.*endurant*
temporary-participant \sqsubseteq *participant*
temporary - participant - in \equiv *temporary - participant*⁻
 \exists *temporary-participant* \sqsubseteq *perdurant*
 $\top \sqsubseteq \forall$ *temporary-participant*.*endurant*
temporary-participant-in \sqsubseteq *participant-in*
temporary - participant - in \equiv *temporary - participant*⁻
 \exists *temporary-participant-in* \sqsubseteq *endurant*
 $\top \sqsubseteq \forall$ *temporary-participant-in*.*perdurant*
temporary-proper-part \sqsubseteq *proper-part*
temporary-proper-part \sqsubseteq *temporary-part*
temporary - proper - part \equiv *temporary - proper - part - of*⁻
 \exists *temporary-proper-part* \sqsubseteq *endurant*
 $\top \sqsubseteq \forall$ *temporary-proper-part*.*endurant*
temporary-proper-part-of \sqsubseteq *proper-part-of*
temporary-proper-part-of \sqsubseteq *temporary-part-of*
temporary - proper - part \equiv *temporary - proper - part - of*⁻
 \exists *temporary-proper-part-of* \sqsubseteq *endurant*
 $\top \sqsubseteq \forall$ *temporary-proper-part-of*.*endurant*
time-of-q-presence-of \sqsubseteq *mediated-relation-i*
time - of - q - presence - of \equiv *q - present - at*⁻
 \exists *time-of-q-presence-of* \sqsubseteq *time-interval*
 $\top \sqsubseteq \forall$ *time-of-q-presence-of*.*physical-quality*
total-constant-participant \sqsubseteq *constant-participant*
total - constant - participant \equiv *total - constant - participant - in*⁻
 \exists *total-constant-participant* \sqsubseteq *perdurant*
 $\top \sqsubseteq \forall$ *total-constant-participant*.*endurant*
total-constant-participant-in \sqsubseteq *constant-participant-in*
total - constant - participant \equiv *total - constant - participant - in*⁻
 \exists *total-constant-participant-in* \sqsubseteq *endurant*
 $\top \sqsubseteq \forall$ *total-constant-participant-in*.*perdurant*
total-temporary-participant \sqsubseteq *temporary-participant*
total - temporary - participant - in \equiv *total - temporary - participant*⁻
 \exists *total-temporary-participant* \sqsubseteq *perdurant*
 $\top \sqsubseteq \forall$ *total-temporary-participant*.*endurant*
total-temporary-participant-in \sqsubseteq *temporary-participant-in*
total - temporary - participant - in \equiv *total - temporary - participant*⁻

\exists *total-temporary-participant-in* \sqsubseteq *endurant*
 $\top \sqsubseteq \forall$ *total-temporary-participant-in.perdurant*
weak-connection \sqsubseteq *immediate-relation*
weak - connection \equiv *weak - connection*⁻
 \exists *weak-connection* \sqsubseteq *particular*
 $\top \sqsubseteq \forall$ *weak-connection.particular*

Data properties

Individuals

3 DOLCE-Lite in Manchester syntax

Namespace: owl2xml <http://www.w3.org/2006/12/owl2-xml#>
 Namespace: DOLCE-Lite <http://www.loa-cnr.it/ontologies/DOLCE-Lite.owl#>
 Namespace: xsd <http://www.w3.org/2001/XMLSchema#>
 Namespace: rdfs <http://www.w3.org/2000/01/rdf-schema#>
 Namespace: rdf <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
 Namespace: owl <http://www.w3.org/2002/07/owl#>

Ontology: <http://www.loa-cnr.it/ontologies/DOLCE-Lite.owl>

Annotations:

owl:versionInfo "397"^^xsd:string,
 owl:versionInfo "classified"^^xsd:string,
 rdfs:comment "The DOLCE and DnS ontologies. OWL engineering by Aldo Gangemi."^^xsd:string

ObjectProperty: atomic-part-of

Domain:
particular

Range:
particular

InverseOf:
atomic-part

SubPropertyOf:
part-of

ObjectProperty: spatio-temporally-present-at

Domain:
particular

Range:
spatio-temporal-region

InverseOf:
spatio-temporal-presence-of

SubPropertyOf:

exact-location

ObjectProperty: host

Annotations:

rdfs:comment "The immediate relation holding for features and entities."^^xsd:string

Domain:

feature

Range:

physical-endurant

InverseOf:

host-of

SubPropertyOf:

specifically-constantly-dependent-on

ObjectProperty: total-constant-participant

Annotations:

rdfs:comment "The perdurant p has a participant e that constantly participates in p with all its parts, e.g. in 'I played the concert' (where the concert is a solo concert)."
^^xsd:string

Domain:

perdurant

Range:

endurant

InverseOf:

total-constant-participant-in

SubPropertyOf:

constant-participant

ObjectProperty: identity-n

Annotations:

rdfs:comment "Any pair of individuals are notionally identical iff they instantiate all and only the same concepts."^^xsd:string

Characteristics:

Transitive

Domain:

particular

Range:

particular

SubPropertyOf:
immediate-relation

ObjectProperty: participant-in

Domain:
endurant

Range:
perdurant

InverseOf:
participant

SubPropertyOf:
immediate-relation-i

ObjectProperty: t-inherent-in

Annotations:
rdfs:comment "The immediate relation holding for qualities and entities at time t."
^^xsd:string

Domain:
quality

Range:
particular

InverseOf:
has-t-quality

SubPropertyOf:
inherent-in

ObjectProperty: specific-constant-constituent-of

Domain:
particular

Range:
particular

InverseOf:
specific-constant-constituent

SubPropertyOf:
immediate-relation-i

ObjectProperty: temporary-part

Annotations:

rdfs:comment "Being part at time t. It holds for endurants only. This is important to model parts that can change or be lost over time without affecting the identity of the whole. In FOL, this is expressed as a ternary relation, but in DLs we only can reason with binary relations, then only the necessary axiom of compresence is represented here."^^xsd:string

Domain:

endurant

Range:

endurant

InverseOf:

temporary-part-of

SubPropertyOf:

part,
partly-compresent

ObjectProperty: specifically-constantly-dependent-on

Domain:

particular

Range:

particular

InverseOf:

specific-constant-dependent

SubPropertyOf:

immediate-relation-i

ObjectProperty: has-quale

Annotations:

rdfs:comment "A quality having a q-location at an atomic region."^^xsd:string

Domain:

quality

Range:

quale

InverseOf:

quale-of

SubPropertyOf:

q-location

ObjectProperty: life-of

Domain:

perdurant

Range:

endurant

InverseOf:

life

SubPropertyOf:

constant-participant

ObjectProperty: generic-dependent

Annotations:

rdfs:comment "The dependence on an individual of a given type at some time. This is traditionally a relation between particulars and universals, but this one states that x generically depends on y if a z different from y, but with the same properties, can be equivalently its depend-on. This is a temporally-indexed relation (embedded in this syntax)."
^^xsd:string

Domain:

particular

Range:

particular

InverseOf:

generically-dependent-on

SubPropertyOf:

immediate-relation

ObjectProperty: immediate-relation-i

Annotations:

rdfs:comment "A relation that holds without additional mediating individuals. In logical terms, a non-composed relation."
^^xsd:string

Domain:

particular

Range:

particular

InverseOf:

immediate-relation

ObjectProperty: temporary-proper-part-of

Domain:
endurant

Range:
endurant

InverseOf:
temporary-proper-part

SubPropertyOf:
proper-part-of,
temporary-part-of

ObjectProperty: weak-connection

Annotations:
rdfs:comment "The basic connection, not requiring a common boundary."^^xsd:string

Domain:
particular

Range:
particular

SubPropertyOf:
immediate-relation

ObjectProperty: partly-compresent

Annotations:
rdfs:comment "A composed (mediated) relation used here to make relations 'temporary': by adding it as a superrelation, the effect is that the two related durants cannot be present at all the same time intervals, but are compresent at least at some time interval (see related axiom). In FOL, the same constraint can be stated directly by coreference. This workaround can be used to index time of relations that involve reciprocal dependency, but it cannot be used in general with relations involving multiple strata of reality. For example, `_about_` relation can be temporally indexed, without involving that the time of the information object overlaps with the time of the entity the information is about (but this works for e.g. the `_realizes_` relation between information objects and entities whatsoever). The different temporal constraints of `about` vs. `expresses` probably derive from the dependency of aboutness from conception (to be about `x`, an information object should also express a description `d` that is satisfied by a situation including `x`, then temporal overlapping of `_about_` is true in virtue of `d`). On the other hand, even `conceives` cannot be indexed in this way, because overlapping does not hold between the time of the conceiving agent, and the conceived description (or situation)."

Domain:
particular

Range:
particular

SubPropertyOf:
mediated-relation

ObjectProperty: strong-connection

Annotations:
rdfs:comment "By strong connection here we mean a connection between two entities that share a boundary."^^xsd:string

Domain:
particular

Range:
particular

SubPropertyOf:
mediated-relation

ObjectProperty: temporary-part-of

Domain:
endurant

Range:
endurant

InverseOf:
temporary-part

SubPropertyOf:
part-of,
partly-compresent

ObjectProperty: has-t-quality

Domain:
particular

Range:
quality

InverseOf:
t-inherent-in

SubPropertyOf:
has-quality

ObjectProperty: constant-participant

Annotations:

rdfs:comment "Anytime x is present, x has participant y. In other words, all parts of x have a same participant.Participation can be constant (in all parts of the perdurant, e.g. in 'the car is running'), or temporary (in only some parts, e.g. in 'I'm electing the president')."^^xsd:string

Domain:

perdurant

Range:

endurant

InverseOf:

constant-participant-in

SubPropertyOf:

participant

ObjectProperty: participant

Annotations:

rdfs:comment "The immediate relation holding between endurants and perdurants (e.g. in 'the car is running').Participation can be constant (in all parts of the perdurant, e.g. in 'the car is running'), or temporary (in only some parts, e.g. in 'I'm electing the president').A 'functional' participant is specialized for those forms of participation that depend on the nature of participants, processes, or on the intentionality of agentive participants. Traditional 'thematic role' should be mapped to functional participation. For relations holding between participants in a same perdurant, see the co-participates relation."^^xsd:string

Domain:

perdurant

Range:

endurant

InverseOf:

participant-in

SubPropertyOf:

immediate-relation

ObjectProperty: proper-part

Annotations:

rdfs:comment "The proper part relation: irreflexive, antisymmetric, and transitive."^^xsd:string

Characteristics:

Transitive

Domain:
particular

Range:
particular

InverseOf:
proper-part-of

SubPropertyOf:
part

ObjectProperty: q-present-at

Annotations:
rdfs:comment "Presence of a physical quality when inheres in an endurant."^^xsd:string

Domain:
physical-quality

Range:
time-interval

InverseOf:
time-of-q-presence-of

SubPropertyOf:
mediated-relation

ObjectProperty: specific-constant-dependent

Annotations:
rdfs:comment "The constant dependence between two individuals. Taken here as primitive."^^xsd:string

Domain:
particular

Range:
particular

InverseOf:
specifically-constantly-dependent-on

SubPropertyOf:
immediate-relation

ObjectProperty: total-constant-participant-in

Domain:
endurant

Range:
perdurant

InverseOf:
total-constant-participant

SubPropertyOf:
constant-participant-in

ObjectProperty: constant-participant-in

Domain:
endurant

Range:
perdurant

InverseOf:
constant-participant

SubPropertyOf:
participant-in

ObjectProperty: abstract-location-of

Domain:
abstract-region

Range:
non-physical-endurant

InverseOf:
abstract-location

SubPropertyOf:
exact-location-of

ObjectProperty: mediated-relation-i

Annotations:
rdfs:comment "A relation that composes other relations. For example, a participation relation composed with a representation relation. Composed relation cannot be directly expressed in OWL-DL, then (at least some) compositions are expressed as class or restriction axioms."^^xsd:string

Domain:
particular

Range:
particular

InverseOf:
mediated-relation

ObjectProperty: atomic-part

Annotations:
rdfs:comment "The part relation between a particular and an atom."^^xsd:string

Domain:
particular

Range:
particular

InverseOf:
atomic-part-of

SubPropertyOf:
part

ObjectProperty: temporary-participant-in

Annotations:
rdfs:comment "x participates in some of y's parts."^^xsd:string

Domain:
endurant

Range:
perdurant

InverseOf:
temporary-participant

SubPropertyOf:
participant-in

ObjectProperty: generic-constituent

Annotations:
rdfs:comment "'Constituent' should depend on some layering of the ontology. For example, scientific granularities or ontological 'strata' are typical layerings. A constituent is a part belonging to a lower layer. Since layering is actually a partition of the ontology, constituents are not properly classified as parts, although this kinship can be intuitive for common sense. Example of specific constant constituents are the entities constituting a setting (a situation), while the entities constituting a collection are examples of generic constant constituents."^^xsd:string

Domain:
particular

Range:
particular

InverseOf:
generic-constituent-of

SubPropertyOf:
immediate-relation

ObjectProperty: temporary-atomic-part

Annotations:
rdfs:comment "Having an atom as part at a time t."^^xsd:string

Domain:
endurant

Range:
endurant

InverseOf:
temporary-atomic-part-of

SubPropertyOf:
temporary-proper-part

ObjectProperty: part-of

Characteristics:
Transitive

Domain:
particular

Range:
particular

InverseOf:
part

SubPropertyOf:
immediate-relation-i

ObjectProperty: generic-location-of

Domain:
particular

Range:
particular

InverseOf:
generic-location

SubPropertyOf:
mediated-relation-i

ObjectProperty: abstract-location

Annotations:
rdfs:comment "Analytical location holding between non-physical endurants and abstract regions."^^xsd:string

Domain:
non-physical-endurant

Range:
abstract-region

InverseOf:
abstract-location-of

SubPropertyOf:
exact-location

ObjectProperty: life

Annotations:
rdfs:comment "Total constant participation applied to the mereological sum of the perdurants in which an endurant participates."^^xsd:string

Domain:
endurant

Range:
perdurant

InverseOf:
life-of

SubPropertyOf:
constant-participant-in

ObjectProperty: has-quality

Domain:
particular

Range:

quality

InverseOf:
inherent-in

SubPropertyOf:
immediate-relation-i

ObjectProperty: part

Annotations:
rdfs:comment "The most generic part relation, reflexive, asymmetric, and transitive."^^xsd:string

Characteristics:
Transitive

Domain:
particular

Range:
particular

InverseOf:
part-of

SubPropertyOf:
immediate-relation

ObjectProperty: specific-constant-constituent

Annotations:
rdfs:comment "'Constituent' should depend on some layering of the ontology. For example, scientific granularities or ontological 'strata' are typical layerings. A constituent is a part belonging to a lower layer. Since layering is actually a partition of the ontology, constituents are not properly classified as parts, although this kinship can be intuitive for common sense. Example of specific constant constituents are the entities constituting a setting (a situation), while the entities constituting a collection are examples of generic constant constituents."^^xsd:string

Domain:
particular

Range:
particular

InverseOf:
specific-constant-constituent-of

SubPropertyOf:
immediate-relation

ObjectProperty: identity-c

Annotations:

rdfs:comment "Any pair of individuals are ontologically identical if they are identical to themselves. Reflexive, symmetric, and transitive."^^xsd:string

Characteristics:

Transitive

Domain:

particular

Range:

particular

SubPropertyOf:

immediate-relation

ObjectProperty: r-location-of

Domain:

region

Range:

region

InverseOf:

r-location

SubPropertyOf:

immediate-relation-i

ObjectProperty: boundary-of

Annotations:

rdfs:comment "A boundary here is taken to be a part (mereological treatment). Consequently, in the case of endurants, (reified) boundaries are features."^^xsd:string

Domain:

particular

Range:

particular

InverseOf:

boundary

SubPropertyOf:

proper-part-of

ObjectProperty: temporary-participant

Annotations:

rdfs:comment "Only some parts of the perdurant p have a participant e. In fact, participation can be constant (in all parts of the perdurant, e.g. in 'the car is running'), or temporary (in only some parts, e.g. in 'I'm electing the president'). Implicitly, this relation has a temporal indexing. If needed, in OWL one can derive such indexing by expliciting what parts of p have e as `_constant_` participant. An appropriate OWL axiom is created to bind this relation to a proper part of it, which has the temporary-participant as a constant one."^^xsd:string

Domain:

perdurant

Range:

endurant

InverseOf:

temporary-participant-in

SubPropertyOf:

participant

ObjectProperty: sibling-part

Annotations:

rdfs:comment "Mereological sibling: having a common whole"^^xsd:string

Domain:

particular

Range:

particular

SubPropertyOf:

mediated-relation

ObjectProperty: overlaps

Annotations:

rdfs:comment "Mereological overlap: having a common part."^^xsd:string

Domain:

particular

Range:

particular

SubPropertyOf:

mediated-relation

ObjectProperty: r-location

Annotations:

rdfs:comment "A relation for representing regions within other regions, e.g. in measurement spaces (space composition).The result of r-location composition is a new 'composed region', which can either preserve the same region type (e.g. physical+physical->physical, or physical+abstract->physical), or not (e.g. physical+abstract->abstract). See 'composition description' for more details.In some cases, space composition is conventional, i.e. a space is just 'located' at another space, as in the case of measurement spaces:(direct composition):
r r-location r1In other cases, r-location implies a complex path, e.g. :(homogeneous composition): r q-location-of q inherent-in x has-quality q1 q-location r1 (heterogeneous composition across endurants and perdurants):
r q-location-of q inherent-in e participant-in p has-quality q1 q-location r1 (heterogeneous composition across physical and non-physical endurants):
r q-location-of q inherent-in pe specific-constant-dependent npe has-quality q1 q-location r1"^^xsd:string

Domain:

region

Range:

region

InverseOf:

r-location-of

SubPropertyOf:

immediate-relation

ObjectProperty: mereologically-coincides

Annotations:

rdfs:comment "Having the same parts at time t."^^xsd:string

Domain:

endurant

Range:

endurant

SubPropertyOf:

temporary-part

ObjectProperty: spatio-temporal-presence-of

Domain:

spatio-temporal-region

Range:

particular

InverseOf:

spatio-temporally-present-at

SubPropertyOf:
exact-location-of

ObjectProperty: total-temporary-participant-in

Domain:
endurant

Range:
perdurant

InverseOf:
total-temporary-participant

SubPropertyOf:
temporary-participant-in

ObjectProperty: inherent-in

Annotations:
rdfs:comment "The immediate relation holding for qualities and entities."^^xsd:string

Domain:
quality

Range:
particular

InverseOf:
has-quality

SubPropertyOf:
immediate-relation

ObjectProperty: immediate-relation

Annotations:
rdfs:comment "A relation that holds without additional mediating individuals.
In logical terms, a non-composed relation."^^xsd:string

Domain:
particular

Range:
particular

InverseOf:
immediate-relation-i

ObjectProperty: quale-of

Domain:
quale

Range:
quality

InverseOf:
has-quale

SubPropertyOf:
q-location-of

ObjectProperty: generically-dependent-on

Domain:
particular

Range:
particular

InverseOf:
generic-dependent

SubPropertyOf:
immediate-relation-i

ObjectProperty: generic-location

Annotations:

rdfs:comment "The most generic location relation, probably equivalent to more than one image schema in a cognitive system (e.g. containment for exact location, proximity for approximate location). This is meant to reason on generalized, common sense as well as formal locations, including naive localization, between any kinds of entities. Generic location is branched into 'exact' location, ranging on regions, and 'approximate' (naive) location, ranging on non-regions."^^xsd:string

Domain:
particular

Range:
particular

InverseOf:
generic-location-of

SubPropertyOf:
mediated-relation

ObjectProperty: generic-constituent-of

Domain:
particular

Range:
particular

InverseOf:
generic-constituent

SubPropertyOf:
immediate-relation-i

ObjectProperty: physical-location

Annotations:
rdfs:comment "Analytical location holding between physical endurants and physical regions."^^xsd:string

Domain:
physical-endurant

Range:
physical-region

InverseOf:
physical-location-of

SubPropertyOf:
exact-location

ObjectProperty: exact-location-of

Domain:
region

Range:
particular

InverseOf:
exact-location

SubPropertyOf:
generic-location-of

ObjectProperty: time-of-q-presence-of

Domain:

time-interval

Range:
physical-quality

InverseOf:
q-present-at

SubPropertyOf:
mediated-relation-i

ObjectProperty: q-location

Annotations:
rdfs:comment "The immediate relation holding for qualities and regions. See
'generic location' branching for the various mediated relations that embed q-location."^^xsd:string

Domain:
quality

Range:
region

InverseOf:
q-location-of

SubPropertyOf:
immediate-relation

ObjectProperty: proper-part-of

Characteristics:
Transitive

Domain:
particular

Range:
particular

InverseOf:
proper-part

SubPropertyOf:
part-of

ObjectProperty: mediated-relation

Annotations:
rdfs:comment "A relation that composes other relations. For example, a
participation relation composed with a representation relation.Composed

relation cannot be directly expressed in OWL-DL, then (at least some) compositions are expressed as class or restriction axioms."^^xsd:string

Domain:
particular

Range:
particular

InverseOf:
mediated-relation-i

ObjectProperty: q-location-of

Domain:
region

Range:
quality

InverseOf:
q-location

SubPropertyOf:
immediate-relation-i

ObjectProperty: temporary-atomic-part-of

Domain:
endurant

Range:
endurant

InverseOf:
temporary-atomic-part

SubPropertyOf:
temporary-proper-part-of

ObjectProperty: host-of

Domain:
physical-endurant

Range:
feature

InverseOf:
host

SubPropertyOf:
specific-constant-dependent

ObjectProperty: boundary

Domain:
particular

Range:
particular

InverseOf:
boundary-of

SubPropertyOf:
proper-part

ObjectProperty: physical-location-of

Domain:
physical-region

Range:
physical-endurant

InverseOf:
physical-location

SubPropertyOf:
exact-location-of

ObjectProperty: exact-location

Annotations:
rdfs:comment "A location relation bounded to regions and defined analytically through the composition of inherence and q-location. This is the analytical version of 'generic location'."^^xsd:string

Domain:
particular

Range:
region

InverseOf:
exact-location-of

SubPropertyOf:
generic-location

ObjectProperty: temporary-proper-part

Annotations:

rdfs:comment "Being proper part at time t. It holds for endurants only. This is important to model proper parts that can change or be lost over time without affecting the identity of the whole."^^xsd:string

Domain:

endurant

Range:

endurant

InverseOf:

temporary-proper-part-of

SubPropertyOf:

proper-part,
temporary-part

ObjectProperty: total-temporary-participant

Annotations:

rdfs:comment "The perdurant p has a participant e that temporarily participates in p with all its parts, e.g. in 'I played the concert' (where I actually played just an overture). See also 'temporary-participant'."^^xsd:string

Domain:

perdurant

Range:

endurant

InverseOf:

total-temporary-participant-in

SubPropertyOf:

temporary-participant

Class: region

Annotations:

rdfs:comment "We distinguish between a quality (e.g., the color of a specific rose), and its value (e.g., a particular shade of red). The latter is called quale, and describes the position of an individual quality within a certain conceptual space (called here quality space) Gardenfors (2000). So when we say that two roses have (exactly) the same color, we mean that their color qualities, which are distinct, have the same position in the color space, that is they have the same color quale."^^xsd:string

SubClassOf:

abstract,

part only region

Class: accomplishment

Annotations:

rdfs:comment "Eventive occurrences (events) are called achievements if they are atomic, otherwise they are accomplishments. Further developments: being 'achievement', 'accomplishment', 'state', 'event', etc. can be also considered 'aspects' of processes or of parts of them. For example, the same process 'rock erosion in the Sinni valley' can be seen as an accomplishment (what has brought the current state that e.g. we are trying to explain), as an achievement (the erosion process as the result of a previous accomplishment), as a state (collapsing the time interval of the erosion into a time point), as an event (what has changed our focus from a state to another). In the erosion case, we could have good motivations to shift from one aspect to another: a) causation focus, b) effectual focus, c) condensation d) transition (causality)."^^xsd:string

SubClassOf:

event

Class: spatio-temporal-particular

Annotations:

rdfs:comment "Dummy class for optimizing some property universes. It includes all entities that are not reifications of universals ('abstracts'), i.e. those entities that are in space-time."^^xsd:string

EquivalentTo:

particular
and (endurant
or perdurant
or quality)

Class: quale

Annotations:

rdfs:comment "An atomic region."^^xsd:string

EquivalentTo:

region
and (atomic-part-of some region)

Class: temporal-quality

Annotations:

rdfs:comment "A quality inherent in a perdurant."^^xsd:string

SubClassOf:

quality,

inherent-in some perdurant,
has-quality only temporal-quality,
q-location only temporal-region

DisjointWith:
physical-quality,
abstract-quality

Class: quality-space

Annotations:
rdfs:comment "A quality space is a topologically maximal region. The constraint of maximality cannot be given completely in OWL, but a constraint is given that creates a partition out of all quality spaces (e.g. no two quality spaces can overlap mereologically)."
^^xsd:string

EquivalentTo:
region
and (overlaps only (not (quality-space)))

Class: proposition

Annotations:
rdfs:comment "The abstract content of a proposition. Abstract content is purely combinatorial: from this viewpoint, any content that can be generated by means of combinatorial rules is assumed to exist in the domain of quantification (reified abstracts)."
^^xsd:string

SubClassOf:
abstract

Class: state

Annotations:
rdfs:comment "Within stative occurrences, we distinguish between states and processes according to homeomericity: sitting is classified as a state but running is classified as a process, since there are (very short) temporal parts of a running that are not themselves runnings. In general, states differ from situations because they are not assumed to have a description from which they depend. They can be sequenced by some course, but they do not require a description as a unifying criterion. On the other hand, at any time, one can conceive a description that asserts the constraints by which a state of a certain type is such, and in this case, it becomes a situation. Since the decision of designing an explicit description that unifies a perdurant depends on context, task, interest, application, etc., when aligning an ontology do DLP, there can be indecision on where to align a state-oriented class. For example, in the WordNet alignment, we have decided to put only some physical states under 'state', e.g. 'turgor', in order to stress the social orientedness of DLP. But whereas we need to talk explicitly of the criteria by which we conceive turgor states, these will be put under 'situation'. Similar considerations are made for the other types of perdurants in DOLCE. A different notion of event (dealing with change) is currently investigated for further

developments: being 'achievement', 'accomplishment', 'state', 'event', etc. can be also considered 'aspects' of processes or of parts of them. For example, the same process 'rock erosion in the Sinni valley' can be conceptualized as an accomplishment (what has brought the current state that e.g. we are trying to explain), as an achievement (the erosion process as the result of a previous accomplishment), as a state (if we collapse the time interval of the erosion into a time point), or as an event (what has changed our focus from a state to another). In the erosion case, we could have good motivations to shift from one aspect to another: a) causation focus, b) effectual focus, c) condensation d) transition (causality). If we want to consider all the aspects of a process together, we need to postulate a unifying descriptive set of criteria (i.e. a 'description'), according to which that process is circumstantiated in a 'situation'. The different aspects will arise as a parts of a same situation."^^xsd:string

SubClassOf:
stative

Class: quality

Annotations:

rdfs:comment "Qualities can be seen as the basic entities we can perceive or measure: shapes, colors, sizes, sounds, smells, as well as weights, lengths, electrical charges... 'Quality' is often used as a synonym of 'property', but this is not the case in this upper ontology: qualities are particulars, properties are universals. Qualities inhere to entities: every entity (including qualities themselves) comes with certain qualities, which exist as long as the entity exists."^^xsd:string

SubClassOf:
spatio-temporal-particular,
inherent-in some particular

DisjointWith:
abstract,
perdurant,
endurant

Class: perdurant

Annotations:

rdfs:comment "Perdurants (AKA occurrences) comprise what are variously called events, processes, phenomena, activities and states. They can have temporal parts or spatial parts. For instance, the first movement of (an execution of) a symphony is a temporal part of the symphony. On the other hand, the play performed by the left side of the orchestra is a spatial part. In both cases, these parts are occurrences themselves. We assume that objects cannot be parts of occurrences, but rather they participate in them. Perdurants extend in time by accumulating different temporal parts, so that, at any time they are present, they are only partially present, in the sense that some of their proper temporal parts (e.g., their previous or future phases) may be not present. E.g., the piece of paper you are reading now is wholly present, while some temporal parts of your reading are not present yet, or any more. Philosophers say that endurants are entities that are in time, while lacking temporal parts (so to speak, all their parts flow with them in time). Perdurants, on the contrary, are entities that happen in time, and can have temporal parts (all

their parts are fixed in time).^^xsd:string

SubClassOf:
spatio-temporal-particular,
has-quality some temporal-location_q,
participant some enduring,
has-quality only temporal-quality,
part only perdurant,
specific-constant-constituent only perdurant

DisjointWith:
abstract,
endurant,
quality

Class: temporal-location_q

Annotations:
rdfs:comment "A temporal location quality."^^xsd:string

SubClassOf:
temporal-quality

Class: achievement

Annotations:
rdfs:comment "Eventive occurrences (events) are called achievements if they are atomic, otherwise they are accomplishments. Further developments: being 'achievement', 'accomplishment', 'state', 'event', etc. can be also considered 'aspects' of processes or of parts of them. For example, the same process 'rock erosion in the Sinni valley' can be seen as an accomplishment (what has brought the current state that e.g. we are trying to explain), as an achievement (the erosion process as the result of a previous accomplishment), as a state (collapsing the time interval of the erosion into a time point), as an event (what has changed our focus from a state to another). In the erosion case, we could have good motivations to shift from one aspect to another: a) causation focus, b) effectual focus, c) condensation d) transition (causality).^^xsd:string

SubClassOf:
event

Class: abstract-quality

Annotations:
rdfs:comment "A quality inherent in a non-physical enduring."^^xsd:string

SubClassOf:
quality,
inherent-in some non-physical-endurant,
has-quality only abstract-quality,
q-location only abstract-region

DisjointWith:
physical-quality,
temporal-quality

Class: amount-of-matter

Annotations:
rdfs:comment "The common trait of amounts of matter is that they are endurants with no unity (according to Gangemi et a. 2001 none of them is an essential whole). Amounts of matter - 'stuffs' referred to by mass nouns like 'gold', 'iron', 'wood', 'sand', 'meat', etc. - are mereologically invariant, in the sense that they change their identity when they change some parts."^^xsd:string

SubClassOf:
physical-endurant

DisjointWith:
feature,
physical-object

Class: endurant

Annotations:
rdfs:comment "The main characteristic of endurants is that all of them are independent essential wholes. This does not mean that the corresponding property (being an endurant) carries proper unity, since there is no common unity criterion for endurants. Endurants can 'genuinely' change in time, in the sense that the very same endurant as a whole can have incompatible properties at different times. To see this, suppose that an endurant - say 'this paper' - has a property at a time t 'it's white', and a different, incompatible property at time t' 'it's yellow': in both cases we refer to the whole object, without picking up any particular part of it. Within endurants, we distinguish between physical and non-physical endurants, according to whether they have direct spatial qualities. Within physical endurants, we distinguish between amounts of matter, objects, and features."^^xsd:string

SubClassOf:
spatio-temporal-particular,
participant-in some perdurant,
part only endurant,
specific-constant-constituent only endurant

DisjointWith:
abstract,
perdurant,
quality

Class: physical-region

Annotations:

rdfs:comment "A region at which only physical qualities can be directly located. It assumes some metrics for physical properties."^^xsd:string

SubClassOf:
region,
part only physical-region,
q-location-of only physical-quality

DisjointWith:
abstract-region,
temporal-region

Class: non-physical-endurant

Annotations:
rdfs:comment "An endurant with no mass, generically constantly depending on some agent. Non-physical endurants can have physical constituents (e.g. in the case of members of a collection).^^xsd:string

SubClassOf:
endurant,
has-quality only abstract-quality,
part only non-physical-endurant

DisjointWith:
arbitrary-sum,
physical-endurant

Class: physical-object

Annotations:
rdfs:comment "The main characteristic of physical objects is that they are endurants with unity. However, they have no common unity criterion, since different subtypes of objects may have different unity criteria. Differently from aggregates, (most) physical objects change some of their parts while keeping their identity, they can have therefore temporary parts. Often physical objects (indeed, all endurants) are ontologically independent from occurrences (discussed below). However, if we admit that every object has a life, it is hard to exclude a mutual specific constant dependence between the two. Nevertheless, we may still use the notion of dependence to (weakly) characterize objects as being not specifically constantly dependent on other objects."^^xsd:string

SubClassOf:
physical-endurant

DisjointWith:
feature,
amount-of-matter

Class: time-interval

Annotations:

rdfs:comment "A temporal region, measured according to a calendar."^^xsd:string

SubClassOf:

temporal-region

Class: process

Annotations:

rdfs:comment "Within stative occurrences, we distinguish between states and processes according to homeomericity: sitting is classified as a state but running is classified as a process, since there are (very short) temporal parts of a running that are not themselves runnings. In general, processes differ from situations because they are not assumed to have a description from which they depend. They can be sequenced by some course, but they do not require a description as a unifying criterion. On the other hand, at any time, one can conceive a description that asserts the constraints by which a process of a certain type is such, and in this case, it becomes a situation. Since the decision of designing an explicit description that unifies a perdurant depends on context, task, interest, application, etc., when aligning an ontology do DLP, there can be indecision on where to align a process-oriented class. For example, in the WordNet alignment, we have decided to put only some physical processes under 'process', e.g. 'organic process', in order to stress the social orientedness of DLP. But whereas we need to talk explicitly of the criteria by which we conceive organic processes, these will be put under 'situation'. Similar considerations are made for the other types of perdurants in DOLCE. A different notion of event (dealing with change) is currently investigated for further developments: being 'achievement', 'accomplishment', 'state', 'event', etc. can be also considered 'aspects' of processes or of parts of them. For example, the same process 'rock erosion in the Sinni valley' can be conceptualized as an accomplishment (what has brought the current state that e.g. we are trying to explain), as an achievement (the erosion process as the result of a previous accomplishment), as a state (if we collapse the time interval of the erosion into a time point), or as an event (what has changed our focus from a state to another). In the erosion case, we could have good motivations to shift from one aspect to another: a) causation focus, b) effectual focus, c) condensation d) transition (causality). If we want to consider all the aspects of a process together, we need to postulate a unifying descriptive set of criteria (i.e. a 'description'), according to which that process is circumstantiated in a 'situation'. The different aspects will arise as a parts of a same situation."^^xsd:string

SubClassOf:

stative

Class: physical-endurant

Annotations:

rdfs:comment "An endurant having a direct physical (at least spatial) quality."^^xsd:string

SubClassOf:

endurant,
has-quality some physical-quality,
has-quality some spatial-location_q,
has-quality only physical-quality,

part only physical-endurant,
specific-constant-constituent only physical-endurant

DisjointWith:
non-physical-endurant,
arbitrary-sum

Class: dependent-place

Annotations:
rdfs:comment "A feature that is not part of its host, like a hole in a piece of cheese, the underneath of a table, the front of a house, or the shadow of a tree."^^xsd:string

SubClassOf:
feature

Class: abstract

Annotations:
rdfs:comment "The main characteristic of abstract entities is that they do not have spatial nor temporal qualities, and they are not qualities themselves. The only class of abstract entities we consider in the present version of the upper ontology is that of quality regions (or simply regions). Quality spaces are special kinds of quality regions, being mereological sums of all the regions related to a certain quality type. The other examples of abstract entities (sets and facts) are only indicative."^^xsd:string

SubClassOf:
particular,
has-quality only (not (spatial-location_q)),
has-quality only (not (temporal-location_q))

DisjointWith:
perdurant,
endurant,
quality

Class: abstract-region

Annotations:
rdfs:comment "A region at which only abstract qualities can be directly located. It assumes some metrics for abstract (neither physical nor temporal) properties."^^xsd:string

SubClassOf:
region,
part only abstract-region,
q-location-of only abstract-quality

DisjointWith:
temporal-region,

physical-region

Class: physical-quality

Annotations:

rdfs:comment "A quality inherent in a physical endurant."^^xsd:string

SubClassOf:

quality,
inherent-in some physical-endurant,
has-quality only physical-quality,
q-location only physical-region

DisjointWith:

temporal-quality,
abstract-quality

Class: temporal-region

Annotations:

rdfs:comment "A region at which only temporal qualities can be directly located. It assumes a metrics for time."^^xsd:string

SubClassOf:

region,
part only temporal-region,
q-location-of only temporal-quality

DisjointWith:

abstract-region,
physical-region

Class: non-physical-object

Annotations:

rdfs:comment "Formerly known as description. A unitary endurant with no mass (non-physical), generically constantly depending on some agent, on some communication act, and indirectly on some agent participating in that act. Both descriptions (in the now current sense) and concepts are non-physical objects."^^xsd:string

SubClassOf:

non-physical-endurant,
generically-dependent-on some physical-endurant,
part only non-physical-object

Class: relevant-part

Annotations:

rdfs:comment "Features that are relevant parts of their host, like a bump or an edge."^^xsd:string

SubClassOf:
feature

Class: arbitrary-sum

Annotations:
rdfs:comment "AKA arbitrary-collection.The mereological sum of any two or more endurants (physical or not). Arbitrary sums have no unity criterion (they are 'extensional')."^^xsd:string

SubClassOf:
endurant,
part some endurant

DisjointWith:
non-physical-endurant,
physical-endurant

Class: set

Annotations:
rdfs:comment "A mathematical set."^^xsd:string

SubClassOf:
abstract

Class: stative

Annotations:
rdfs:comment "An occurrence-type is stative or eventive according to whether it holds of the mereological sum of two of its instances, i.e. if it is cumulative or not. A sitting occurrence is stative since the sum of two sittings is still a sitting occurrence."^^xsd:string

SubClassOf:
perdurant

Class: event

Annotations:
rdfs:comment "An occurrence-type is stative or eventive according to whether it holds of the mereological sum of two of its instances, i.e. if it is cumulative or not. A sitting occurrence is stative since the sum of two sittings is still a sitting occurrence. In general, events differ from situations because they are not assumed to have a description from which they depend. They can be sequenced by some course, but they do not require a description as a unifying criterion.On the other hand,

at any time, one can conceive a description that asserts the constraints by which an event of a certain type is such, and in this case, it becomes a situation. Since the decision of designing an explicit description that unifies a perdurant depends on context, task, interest, application, etc., when aligning an ontology to DLP, there can be indecision on where to align an event-oriented class. For example, in the WordNet alignment, we have decided to put only some physical events under 'event', e.g. 'discharge', in order to stress the social orientedness of DLP. But whereas we need to talk explicitly of the criteria by which we conceive discharge events, these will be put under 'situation'. Similar considerations are made for the other types of perdurants in DOLCE. A different notion of event (dealing with change) is currently investigated for further developments: being 'achievement', 'accomplishment', 'state', 'event', etc. can be also considered 'aspects' of processes or of parts of them. For example, the same process 'rock erosion in the Sinni valley' can be conceptualized as an accomplishment (what has brought the current state that e.g. we are trying to explain), as an achievement (the erosion process as the result of a previous accomplishment), as a state (if we collapse the time interval of the erosion into a time point), or as an event (what has changed our focus from a state to another). In the erosion case, we could have good motivations to shift from one aspect to another: a) causation focus, b) effectual focus, c) condensation d) transition (causality). If we want to consider all the aspects of a process together, we need to postulate a unifying descriptive set of criteria (i.e. a 'description'), according to which that process is circumstantiated in a 'situation'. The different aspects will arise as a parts of a same situation."^^xsd:string

SubClassOf:
perdurant

Class: spatial-location_q

Annotations:
rdfs:comment "A physical quality, q-located in (whose value is given within) ordinary spaces (geographical coordinates, cosmological positions, anatomical axes, etc.)."^^xsd:string

SubClassOf:
physical-quality

Class: particular

Annotations:
rdfs:comment "AKA 'entity'. Any individual in the DOLCE domain of discourse. The extensional coverage of DOLCE is as large as possible, since it ranges on 'possibilia', i.e. all possible individuals that can be postulated by means of DOLCE axioms. Possibilia include physical objects, substances, processes, qualities, conceptual regions, non-physical objects, collections and even arbitrary sums of objects. The class 'particular' features a covering partition that includes: enduring, perdurant, quality, and abstract. There are also some subclasses defined as unions of subclasses of 'particular' for special purposes: spatio-temporal-particular (any particular except abstracts)-physical-realization (any realization of an information object, defined in the ExtendedDnS ontology)."^^xsd:string

Class: feature

Annotations:

rdfs:comment "Features are 'parasitic entities', that exist insofar their host exists. Typical examples of features are holes, bumps, boundaries, or spots of color. Features may be relevant parts of their host, like a bump or an edge, or dependent regions like a hole in a piece of cheese, the underneath of a table, the front of a house, or the shadow of a tree, which are not parts of their host. All features are essential wholes, but no common unity criterion may exist for all of them. However, typical features have a topological unity, as they are singular entities. Here only features of physical endurants are considered."^^xsd:string

SubClassOf:

physical-endurant,
host some physical-endurant

DisjointWith:

amount-of-matter,
physical-object

Class: space-region

Annotations:

rdfs:comment "An ordinary space: geographical, cosmological, anatomical, topographic, etc."^^xsd:string

SubClassOf:

physical-region,
part only space-region,
q-location-of only spatial-location_q

Class: spatio-temporal-region

Annotations:

rdfs:comment "Any region resulting from the composition of a space region with a temporal region, i.e. being present in region r at time t."^^xsd:string

SubClassOf:

space-region

4 BFO-1.1 in DL

Classes

$ConnectedSpatiotemporalRegion \equiv SpatiotemporalInstant \sqcup SpatiotemporalInterval$

$ConnectedSpatiotemporalRegion \sqsubseteq SpatiotemporalRegion$

$ConnectedSpatiotemporalRegion \sqsubseteq \neg ScatteredSpatiotemporalRegion$

$ConnectedTemporalRegion \equiv TemporalInstant \sqcup TemporalInterval$

$ConnectedTemporalRegion \sqsubseteq TemporalRegion$

ConnectedTemporalRegion \sqsubseteq \neg *ScatteredTemporalRegion*
Continuant \equiv *DependentContinuant* \sqcup *IndependentContinuant* \sqcup *SpatialRegion*
Continuant \sqsubseteq *Entity*
Continuant \sqsubseteq \neg *Occurrent*
DependentContinuant \equiv *GenericallyDependentContinuant* \sqcup *SpecificallyDependentContinuant*
DependentContinuant \sqsubseteq *Continuant*
DependentContinuant \sqsubseteq \neg *SpatialRegion*
DependentContinuant \sqsubseteq \neg *IndependentContinuant*
Disposition \sqsubseteq *RealizableEntity*
Disposition \sqsubseteq \neg *Role*
Disposition \sqsubseteq \neg *Function*
Entity \equiv *Continuant* \sqcup *Occurrent*
FiatObjectPart \sqsubseteq *MaterialEntity*
FiatObjectPart \sqsubseteq \neg *Object*
FiatObjectPart \sqsubseteq \neg *ObjectAggregate*
FiatObjectPart \sqsubseteq \neg *Site*
FiatObjectPart \sqsubseteq \neg *ObjectBoundary*
FiatProcessPart \sqsubseteq *ProcessualEntity*
FiatProcessPart \sqsubseteq \neg *ProcessualContext*
FiatProcessPart \sqsubseteq \neg *Process*
FiatProcessPart \sqsubseteq \neg *ProcessAggregate*
FiatProcessPart \sqsubseteq \neg *ProcessBoundary*
Function \sqsubseteq *RealizableEntity*
Function \sqsubseteq \neg *Role*
Function \sqsubseteq \neg *Disposition*
GenericallyDependentContinuant \sqsubseteq *DependentContinuant*
GenericallyDependentContinuant \sqsubseteq \neg *SpecificallyDependentContinuant*
IndependentContinuant \equiv *MaterialEntity* \sqcup *ObjectBoundary* \sqcup *Site*
IndependentContinuant \sqsubseteq *Continuant*
IndependentContinuant \sqsubseteq \neg *DependentContinuant*
IndependentContinuant \sqsubseteq \neg *SpatialRegion*
MaterialEntity \equiv *FiatObjectPart* \sqcup *Object* \sqcup *ObjectAggregate*
MaterialEntity \sqsubseteq *IndependentContinuant*
MaterialEntity \sqsubseteq \neg *ObjectBoundary*
MaterialEntity \sqsubseteq \neg *Site*
Object \sqsubseteq *MaterialEntity*
Object \sqsubseteq \neg *ObjectBoundary*
Object \sqsubseteq \neg *ObjectAggregate*
Object \sqsubseteq \neg *Site*
Object \sqsubseteq \neg *FiatObjectPart*
ObjectAggregate \sqsubseteq *MaterialEntity*
ObjectAggregate \sqsubseteq \neg *Object*
ObjectAggregate \sqsubseteq \neg *FiatObjectPart*
ObjectAggregate \sqsubseteq \neg *ObjectBoundary*
ObjectAggregate \sqsubseteq \neg *Site*
ObjectBoundary \sqsubseteq *IndependentContinuant*
ObjectBoundary \sqsubseteq \neg *Object*
ObjectBoundary \sqsubseteq \neg *MaterialEntity*
ObjectBoundary \sqsubseteq \neg *ObjectAggregate*
ObjectBoundary \sqsubseteq \neg *Site*
ObjectBoundary \sqsubseteq \neg *FiatObjectPart*
Occurrent \equiv *ProcessualEntity* \sqcup *SpatiotemporalRegion* \sqcup *TemporalRegion*
Occurrent \sqsubseteq *Entity*
Occurrent \sqsubseteq \neg *Continuant*
OneDimensionalRegion \sqsubseteq *SpatialRegion*
OneDimensionalRegion \sqsubseteq \neg *ZeroDimensionalRegion*
OneDimensionalRegion \sqsubseteq \neg *ThreeDimensionalRegion*

OneDimensionalRegion \sqsubseteq \neg *TwoDimensionalRegion*
Process \sqsubseteq *ProcessualEntity*
Process \sqsubseteq \neg *ProcessualContext*
Process \sqsubseteq \neg *ProcessAggregate*
Process \sqsubseteq \neg *ProcessBoundary*
Process \sqsubseteq \neg *FiatProcessPart*
ProcessAggregate \sqsubseteq *ProcessualEntity*
ProcessAggregate \sqsubseteq \neg *ProcessBoundary*
ProcessAggregate \sqsubseteq \neg *ProcessualContext*
ProcessAggregate \sqsubseteq \neg *Process*
ProcessAggregate \sqsubseteq \neg *FiatProcessPart*
ProcessBoundary \sqsubseteq *ProcessualEntity*
ProcessBoundary \sqsubseteq \neg *ProcessAggregate*
ProcessBoundary \sqsubseteq \neg *ProcessualContext*
ProcessBoundary \sqsubseteq \neg *Process*
ProcessBoundary \sqsubseteq \neg *FiatProcessPart*
ProcessualContext \sqsubseteq *ProcessualEntity*
ProcessualContext \sqsubseteq \neg *Process*
ProcessualContext \sqsubseteq \neg *ProcessAggregate*
ProcessualContext \sqsubseteq \neg *ProcessBoundary*
ProcessualContext \sqsubseteq \neg *FiatProcessPart*
ProcessualEntity \equiv *FiatProcessPart* \sqcup *Process* \sqcup *ProcessAggregate* \sqcup *ProcessBoundary* \sqcup *ProcessualContext*
ProcessualEntity \sqsubseteq *Occurrent*
ProcessualEntity \sqsubseteq \neg *SpatiotemporalRegion*
ProcessualEntity \sqsubseteq \neg *TemporalRegion*
Quality \sqsubseteq *SpecificallyDependentContinuant*
Quality \sqsubseteq \neg *RealizableEntity*
RealizableEntity \sqsubseteq *SpecificallyDependentContinuant*
RealizableEntity \sqsubseteq \neg *Quality*
Role \sqsubseteq *RealizableEntity*
Role \sqsubseteq \neg *Function*
Role \sqsubseteq \neg *Disposition*
ScatteredSpatiotemporalRegion \sqsubseteq *SpatiotemporalRegion*
ScatteredSpatiotemporalRegion \sqsubseteq \neg *ConnectedSpatiotemporalRegion*
ScatteredTemporalRegion \sqsubseteq *TemporalRegion*
ScatteredTemporalRegion \sqsubseteq \neg *ConnectedTemporalRegion*
Site \sqsubseteq *IndependentContinuant*
Site \sqsubseteq \neg *Object*
Site \sqsubseteq \neg *MaterialEntity*
Site \sqsubseteq \neg *ObjectBoundary*
Site \sqsubseteq \neg *FiatObjectPart*
Site \sqsubseteq \neg *ObjectAggregate*
SpatialRegion \equiv *OneDimensionalRegion* \sqcup *ThreeDimensionalRegion* \sqcup *TwoDimensionalRegion* \sqcup *ZeroDimensionalRegion*
SpatialRegion \sqsubseteq *Continuant*
SpatialRegion \sqsubseteq \neg *DependentContinuant*
SpatialRegion \sqsubseteq \neg *IndependentContinuant*
SpatiotemporalInstant \sqsubseteq *ConnectedSpatiotemporalRegion*
SpatiotemporalInstant \sqsubseteq \neg *SpatiotemporalInterval*
SpatiotemporalInterval \sqsubseteq *ConnectedSpatiotemporalRegion*
SpatiotemporalInterval \sqsubseteq \neg *SpatiotemporalInstant*
SpatiotemporalRegion \equiv *ConnectedSpatiotemporalRegion* \sqcup *ScatteredSpatiotemporalRegion*
SpatiotemporalRegion \sqsubseteq *Occurrent*
SpatiotemporalRegion \sqsubseteq \neg *ProcessualEntity*
SpatiotemporalRegion \sqsubseteq \neg *TemporalRegion*
SpecificallyDependentContinuant \equiv *Quality* \sqcup *RealizableEntity*
SpecificallyDependentContinuant \sqsubseteq *DependentContinuant*
SpecificallyDependentContinuant \sqsubseteq \neg *GenericallyDependentContinuant*

TemporalInstant \sqsubseteq *ConnectedTemporalRegion*
TemporalInstant \sqsubseteq \neg *TemporalInterval*
TemporalInterval \sqsubseteq *ConnectedTemporalRegion*
TemporalInterval \sqsubseteq \neg *TemporalInstant*
TemporalRegion \equiv *ConnectedTemporalRegion* \sqcup *ScatteredTemporalRegion*
TemporalRegion \sqsubseteq *Occurrent*
TemporalRegion \sqsubseteq \neg *ProcessualEntity*
TemporalRegion \sqsubseteq \neg *SpatiotemporalRegion*
ThreeDimensionalRegion \sqsubseteq *SpatialRegion*
ThreeDimensionalRegion \sqsubseteq \neg *ZeroDimensionalRegion*
ThreeDimensionalRegion \sqsubseteq \neg *TwoDimensionalRegion*
ThreeDimensionalRegion \sqsubseteq \neg *OneDimensionalRegion*
TwoDimensionalRegion \sqsubseteq *SpatialRegion*
TwoDimensionalRegion \sqsubseteq \neg *ThreeDimensionalRegion*
TwoDimensionalRegion \sqsubseteq \neg *ZeroDimensionalRegion*
TwoDimensionalRegion \sqsubseteq \neg *OneDimensionalRegion*
ZeroDimensionalRegion \sqsubseteq *SpatialRegion*
ZeroDimensionalRegion \sqsubseteq \neg *OneDimensionalRegion*
ZeroDimensionalRegion \sqsubseteq \neg *ThreeDimensionalRegion*
ZeroDimensionalRegion \sqsubseteq \neg *TwoDimensionalRegion*

Object properties

Data properties

Individuals

5 BFO-1.1 in Manchester syntax

Namespace: owl2xml <<http://www.w3.org/2006/12/owl2-xml#>>
 Namespace: snap <<http://www.ifomis.org/bfo/1.1/snap#>>
 Namespace: xsd <<http://www.w3.org/2001/XMLSchema#>>
 Namespace: dc <<http://purl.org/dc/elements/1.1/>>
 Namespace: bfo <<http://www.ifomis.org/bfo/1.1#>>
 Namespace: rdfs <<http://www.w3.org/2000/01/rdf-schema#>>
 Namespace: rdf <<http://www.w3.org/1999/02/22-rdf-syntax-ns#>>
 Namespace: span <<http://www.ifomis.org/bfo/1.1/span#>>
 Namespace: owl <<http://www.w3.org/2002/07/owl#>>

Ontology: <<http://www.ifomis.org/bfo/1.1>>

Annotations:

dc:source "Pierre Grenon: "Nuts in BFO's Nutshell: Revisions to the Bi-categorical
 Axiomatization of BFO""^^xsd:string,
 dc:source "Pierre Grenon, Barry Smith and Louis Goldberg: "Biodynamic Ontology:
 Applying BFO in the Biomedical Domain""^^xsd:string,
 dc:source "Barry Smith: "Beyond Concepts: Ontology as Reality
 Representation""^^xsd:string,
 dc:contributor "Pierre Grenon"^^xsd:string,
 dc:format "application/rdf+xml"^^xsd:string,
 dc:creator "Holger Stenzhorn"^^xsd:string,
 dc:contributor "Alan Ruttenberg"^^xsd:string,
 dc:language "en"^^xsd:string,
 dc:rights "http://creativecommons.org/licenses/by/3.0",
 dc:source "Barry Smith and Pierre Grenon: "The Cornucopia of Formal Ontological

Relations""^^xsd:string,
dc:source "Pierre Grenon: "BFO in a Nutshell: A Bi-categorical Axiomatization of BFO and Comparison with DOLCE""^^xsd:string,
dc:identifier "http://www.ifomis.org/bfo/1.1""^^xsd:string,
dc:source "Barry Smith: "Against Fantology""^^xsd:string,
dc:title "Basic Formal Ontology (BFO)""^^xsd:string,
dc:source "Pierre Grenon: "Spatio-temporality in Basic Formal Ontology: SNAP and SPAN, Upper-Level Ontology, and Framework for Formalization""^^xsd:string,
dc:contributor "Andrew Spear""^^xsd:string,
owl:versionInfo "1.1.1""^^xsd:string,
dc:source "Barry Smith: "Basic Tools of Formal Ontology""^^xsd:string,
dc:source "Pierre Grenon and Barry Smith: "SNAP and SPAN: Towards Geospatial Dynamics""^^xsd:string,
dc:publisher "Institute for Formal Ontology and Medical Information Science (IFOMIS)""^^xsd:string

Class: span:Occurrent

Annotations:

rdfs:comment "Definition: An entity [bfo:Entity] that has temporal parts and that happens, unfolds or develops through time. Sometimes also called perdurants."
^^xsd:string,
rdfs:comment "Synonyms: perdurant""^^xsd:string,
rdfs:comment "Examples: the life of an organism, a surgical operation as processual context for a nosocomical infection, the spatiotemporal context occupied by a process of cellular meiosis, the most interesting part of Van Gogh's life, the spatiotemporal region occupied by the development of a cancer tumor""^^xsd:string,
rdfs:label "occurrent""^^xsd:string

EquivalentTo:

span:ProcessualEntity
or span:SpatiotemporalRegion
or span:TemporalRegion

SubClassOf:

Entity

DisjointWith:

snap:Continuant

Class: span:TemporalRegion

Annotations:

rdfs:comment "Definition: An occurrent [span:Occurrent] that is part of time."
^^xsd:string,
rdfs:comment "Examples: the time it takes to run a marathon, the duration of a surgical procedure, the moment of death""^^xsd:string,
rdfs:comment "Comment: All instances of occurrent [span:Occurrent] are temporal entities, that is, they enter in the relation of (temporal) location with temporal region [span:TemporalRegion] entities. As a particular case, the exact spatiotemporal location of a temporal region [span:TemporalRegion] is this region itself. Continuant [snap:Continuant] entities are not temporal entities in the technical sense just explained; they are related to time in a different way, not through temporal location but through a relation of existence

at a time or during a period of time (see `continuant [snap:Continuant]`).
`rdfs:label "temporal_region"`
`rdfs:comment "Comment: Time and temporal region [span:TemporalRegion] entities are entities in their own rights which exist independently of any entities which can be located at them. This view of time can be called "absolutist" or "the container view" in analogy to what is traditionally the case with space (see spatial region [snap:SpatialRegion])." "rdfs:comment "Comment: An instance of temporal region [span:TemporalRegion] is a part of time. All parts of time are temporal region [span:TemporalRegion] entities and only temporal region [span:TemporalRegion] entities are parts of time. Time is the entire extent of the temporal universe, a designated individual, which is thus a temporal region itself."`

EquivalentTo:

`span:ConnectedTemporalRegion`
or `span:ScatteredTemporalRegion`

SubClassOf:

`span:Occurrent`

DisjointWith:

`span:ProcessualEntity`,
`span:SpatiotemporalRegion`

Class: `span:Process`

Annotations:

`rdfs:comment "Examples: the life of an organism, the process of sleeping, the process of cell-division"`
`rdfs:comment "Definition: A processual entity [span:ProcessualEntity] that is a maximally connected spatiotemporal whole and has bona fide beginnings and endings corresponding to real discontinuities."`
`rdfs:label "process"`

SubClassOf:

`span:ProcessualEntity`

DisjointWith:

`span:ProcessAggregate`,
`span:FiatProcessPart`,
`span:ProcessBoundary`,
`span:ProcessualContext`

Class: `span:ScatteredTemporalRegion`

Annotations:

`rdfs:comment "Examples: the time occupied by the individual games of the World Cup, the time occupied by the individual liaisons in a romantic affair"`
`rdfs:label "scattered_temporal_region"`
`rdfs:comment "Definition: A temporal region [span:TemporalRegion] every point of which is not mediately or immediately connected with every other point of which."`

SubClassOf:

span:TemporalRegion

DisjointWith:

span:ConnectedTemporalRegion

Class: snap:MaterialEntity

Annotations:

rdfs:comment "Examples: collection of random bacteria, a chair, dorsal surface of the body"^^xsd:string,
rdfs:label "material_entity"^^xsd:string,
rdfs:comment "Definition: An independent continuant [snap:IndependentContinuant] that is spatially extended whose identity is independent of that of other entities and can be maintained through time. Note: Material entity [snap:MaterialEntity] subsumes object [snap:Object], fiat object part [snap:FiatObjectPart], and object aggregate [snap:ObjectAggregate], which assume a three level theory of granularity, which is inadequate for some domains, such as biology."^^xsd:string

EquivalentTo:

snap:FiatObjectPart
or snap:Object
or snap:ObjectAggregate

SubClassOf:

snap:IndependentContinuant

DisjointWith:

snap:Site,
snap:ObjectBoundary

Class: span:ConnectedTemporalRegion

Annotations:

rdfs:comment "Definition: A temporal region [span:TemporalRegion] every point of which is mediately or immediately connected with every other point of which."^^xsd:string,
rdfs:comment "Examples: the 1970s years, the time from the beginning to the end of a heart attack, the time taken up by cellular meiosis"^^xsd:string,
rdfs:label "connected_temporal_region"^^xsd:string

EquivalentTo:

span:TemporalInstant
or span:TemporalInterval

SubClassOf:

span:TemporalRegion

DisjointWith:

span:ScatteredTemporalRegion

Class: snap:Continuant

Annotations:

rdfs:label "continuant"^^xsd:string,
rdfs:comment "Definition: An entity [bfo:Entity] that exists in full at any time in which it exists at all, persists through time while maintaining its identity and has no temporal parts."^^xsd:string,
rdfs:comment "Examples: a heart, a person, the color of a tomato, the mass of a cloud, a symphony orchestra, the disposition of blood to coagulate, the lawn and atmosphere in front of our building"^^xsd:string,
rdfs:comment "Synonyms: enduring"^^xsd:string

EquivalentTo:

snap:DependentContinuant
or snap:IndependentContinuant
or snap:SpatialRegion

SubClassOf:

Entity

DisjointWith:

span:Occurrent

Class: snap:RealizableEntity

Annotations:

rdfs:label "realizable_entity"^^xsd:string,
rdfs:comment "Definition: A specifically dependent continuant [snap:SpecificallyDependentContinuant] that inheres in continuant [snap:Continuant] entities and are not exhibited in full at every time in which it inheres in an entity or group of entities. The exhibition or actualization of a realizable entity is a particular manifestation, functioning or process that occurs under certain circumstances."^^xsd:string,
rdfs:comment "Comment: If a realizable entity [snap:RealizableEntity] inheres in a continuant [snap:Continuant], this does not imply that it is actually realized."^^xsd:string,
rdfs:comment "Examples: the role of being a doctor, the function of the reproductive organs, the disposition of blood to coagulate, the disposition of metal to conduct electricity"^^xsd:string

SubClassOf:

snap:SpecificallyDependentContinuant

DisjointWith:

snap:Quality

Class: snap:Object

Annotations:

rdfs:comment "Synonyms: substance"^^xsd:string,
rdfs:label "object"^^xsd:string,
rdfs:comment "Definition: A material entity [snap:MaterialEntity] that is spatially extended, maximally self-connected and self-contained (the parts of a substance are not separated from each other by spatial gaps) and possesses an internal unity. The identity of substantial object

```
[snap:Object] entities is independent of that of other entities and can be
maintained through time."^^xsd:string,
rdfs:comment "Examples: an organism, a heart, a chair, a lung, an
apple"^^xsd:string
```

```
SubClassOf:
  snap:MaterialEntity
```

```
DisjointWith:
  snap:Site,
  snap:ObjectAggregate,
  snap:FiatObjectPart,
  snap:ObjectBoundary
```

```
Class: span:ProcessAggregate
```

```
Annotations:
  rdfs:comment "Examples: the beating of the hearts of each of seven individuals
in the room, the playing of each of the members of an orchestra, a process of
digestion and a process of thinking taken together"^^xsd:string,
  rdfs:label "process_aggregate"^^xsd:string,
  rdfs:comment "Definition: A processual entity [span:ProcessualEntity] that is
a mereological sum of process [span:Process] entities and possesses non-
connected boundaries."^^xsd:string
```

```
SubClassOf:
  span:ProcessualEntity
```

```
DisjointWith:
  span:FiatProcessPart,
  span:ProcessBoundary,
  span:Process,
  span:ProcessualContext
```

```
Class: span:ProcessualEntity
```

```
Annotations:
  rdfs:comment "Definition: An occurrent [span:Occurrent] that exists in time by
occurring or happening, has temporal parts and always involves and depends
on some entity."^^xsd:string,
  rdfs:label "processual_entity"^^xsd:string,
  rdfs:comment "Examples: the life of an organism, the process of meiosis, the
course of a disease, the flight of a bird"^^xsd:string
```

```
EquivalentTo:
  span:FiatProcessPart
  or span:Process
  or span:ProcessAggregate
  or span:ProcessBoundary
  or span:ProcessualContext
```

```
SubClassOf:
  span:Occurrent
```

DisjointWith:
span:TemporalRegion,
span:SpatiotemporalRegion

Class: snap:ObjectAggregate

Annotations:
rdfs:comment "Synonyms: substance aggregate"^^xsd:string,
rdfs:comment "Examples: a heap of stones, a group of commuters on the subway,
a collection of random bacteria, a flock of geese, the patients in a hospital"^^xsd:string,
rdfs:comment "Definition: A material entity [snap:MaterialEntity] that is a
mereological sum of separate object [snap:Object] entities and possesses non-
connected boundaries."^^xsd:string,
rdfs:label "object_aggregate"^^xsd:string

SubClassOf:
snap:MaterialEntity

DisjointWith:
snap:Site,
snap:FiatObjectPart,
snap:ObjectBoundary,
snap:Object

Class: span:ProcessBoundary

Annotations:
rdfs:label "process_boundary"^^xsd:string,
rdfs:comment "Examples: birth, death, the forming of a synapse, the onset of
REM sleep, the detaching of a finger in an industrial accident, the final
separation of two cells at the end of cell-division, the incision at the beginning
of a surgery"^^xsd:string,
rdfs:comment "Definition: A processual entity [span:ProcessualEntity] that is
the fiat or bona fide instantaneous temporal process boundary."^^xsd:string

SubClassOf:
span:ProcessualEntity

DisjointWith:
span:ProcessAggregate,
span:FiatProcessPart,
span:Process,
span:ProcessualContext

Class: snap:TwoDimensionalRegion

Annotations:
rdfs:comment "Examples: the surface of a cube-shaped part of space, the
surface of a sphere-shaped part of space, the surface of a rectilinear planar
figure-shaped part of space"^^xsd:string,

```
    rdfs:comment "Definition: A spatial region [snap:SpatialRegion] with two
dimensions."^^xsd:string,
    rdfs:label "two_dimensional_region"^^xsd:string
```

```
SubClassOf:
    snap:SpatialRegion
```

```
DisjointWith:
    snap:ThreeDimensionalRegion,
    snap:ZeroDimensionalRegion,
    snap:OneDimensionalRegion
```

Class: snap:ObjectBoundary

```
Annotations:
    rdfs:comment "Definition: An independent continuant [snap:Independent-
Continuant] that is a lower dimensional part of a spatial entity, normally a
closed two-dimensional surface. Boundaries are those privileged parts of
object [snap:Object] entities that exist at exactly the point where the object
[snap:Object] is separated off from the rest of the existing entities in the
world."^^xsd:string,
    rdfs:comment "Comment: Boundaries are theoretically difficult entities to
account for, however the intuitive notion of a physical boundary as a
surface of some sort (whether inside or outside of a thing) will generally
serve as a good guide for the use of this universal."^^xsd:string,
    rdfs:comment "Examples: the surface of the skin, the surface of the earth,
the surface of the interior of the stomach, the outer surface of a cell or
cell wall"^^xsd:string,
    rdfs:comment "Synonyms: substance boundary"^^xsd:string,
    rdfs:label "object_boundary"^^xsd:string
```

```
SubClassOf:
    snap:IndependentContinuant
```

```
DisjointWith:
    snap:Site,
    snap:ObjectAggregate,
    snap:FiatObjectPart,
    snap:MaterialEntity,
    snap:Object
```

Class: snap:SpecificallyDependentContinuant

```
Annotations:
    rdfs:label "specifically_dependent_continuant"^^xsd:string,
    rdfs:comment "Definition: A continuant [snap:Continuant] that inheres in or
is borne by other entities. Every instance of A requires some specific instance
of B which must always be the same."^^xsd:string,
    rdfs:comment "Examples: the mass of a cloud, the smell of mozzarella,
the liquidity of blood, the color of a tomato, the disposition of fish to decay,
the role of being a doctor, the function of the heart in the body: to pump blood,
to receive de-oxygenated and oxygenated blood, etc."^^xsd:string,
    rdfs:comment "Synonyms: property, trope, mode"^^xsd:string
```

EquivalentTo:
 snap:Quality
 or snap:RealizableEntity

SubClassOf:
 snap:DependentContinuant

DisjointWith:
 snap:GenericallyDependentContinuant

Class: Entity

Annotations:
 rdfs:label "entity"^^xsd:string

EquivalentTo:
 snap:Continuant
 or span:Occurrent

Class: span:ProcessualContext

Annotations:
 rdfs:comment "Examples: The processual context for a given manipulation occurring as part of an experiment is made of processual entities which occur in parallel, are not necessarily all parts of the experiment themselves and may involve continuant [snap:Continuant] entities which are in the spatial vicinity of the participants in the experiment."^^xsd:string,
 rdfs:comment "Comment: An instance of a processual context [span:ProcessualContext] is a mixture of processual entity [span:ProcessualEntity] which stand as surrounding environments for other processual entity [span:ProcessualEntity] entities. The class processual context [span:ProcessualContext] is the analogous among occurrent [span:Occurrent] entities to the class site [snap:Site] among continuant [snap:Continuant] entities."^^xsd:string,
 rdfs:label "processual_context"^^xsd:string,
 rdfs:comment "Definition: An occurrent [span:Occurrent] consisting of a characteristic spatial shape inhering in some arrangement of other occurrent [span:Occurrent] entities. Processual context [span:ProcessualContext] entities are characteristically entities at or in which other occurrent [span:Occurrent] entities can be located or occur."^^xsd:string

SubClassOf:
 span:ProcessualEntity

DisjointWith:
 span:ProcessAggregate,
 span:FiatProcessPart,
 span:ProcessBoundary,
 span:Process

Class: span:ConnectedSpatiotemporalRegion

Annotations:

rdfs:comment "Definition: A spatiotemporal region [span:SpatiotemporalRegion] that has temporal and spatial dimensions such that all points within the spatiotemporal region are mediately or immediately connected to all other points within the same spatiotemporal region [span:SpatiotemporalRegion]."^^xsd:string,
rdfs:comment "Examples: the spatial and temporal location of an individual organism's life, the spatial and temporal location of the development of a fetus"^^xsd:string,
rdfs:label "connected_spatiotemporal_region"^^xsd:string

EquivalentTo:

span:SpatiotemporalInstant
or span:SpatiotemporalInterval

SubClassOf:

span:SpatiotemporalRegion

DisjointWith:

span:ScatteredSpatiotemporalRegion

Class: span:SpatiotemporalInstant

Annotations:

rdfs:label "spatiotemporal_instant"^^xsd:string,
rdfs:comment "Definition: A connected spatiotemporal region [span:Connected-SpatiotemporalRegion] at a specific moment."^^xsd:string,
rdfs:comment "Examples: the spatiotemporal region occupied by a single instantaneous temporal slice (part) of a process"^^xsd:string

SubClassOf:

span:ConnectedSpatiotemporalRegion

DisjointWith:

span:SpatiotemporalInterval

Class: span:TemporalInterval

Annotations:

rdfs:comment "Examples: any continuous temporal duration during which a process occurs"^^xsd:string,
rdfs:label "temporal_interval"^^xsd:string,
rdfs:comment "Definition: A connected temporal region [span:Connected-TemporalRegion] lasting for more than a single moment of time."^^xsd:string

SubClassOf:

span:ConnectedTemporalRegion

DisjointWith:

span:TemporalInstant

Class: span:SpatiotemporalInterval

Annotations:

rdfs:label "spatiotemporal_interval"^^xsd:string,
rdfs:comment "Examples: the spatiotemporal region occupied by a process
or by a fiat processual part"^^xsd:string,
rdfs:comment "Definition: A connected spatiotemporal region [span:Connected-
SpatiotemporalRegion] that endures for more than a single moment of time."^^xsd:string

SubClassOf:

span:ConnectedSpatiotemporalRegion

DisjointWith:

span:SpatiotemporalInstant

Class: snap:Site

Annotations:

rdfs:comment "Definition: An independent continuant [snap:IndependentContinuant]
consisting of a characteristic spatial shape in relation to some arrangement of other
continuant [snap:Continuant] entities and of the medium which is enclosed in whole
or in part by this characteristic spatial shape. Site [snap:Site] entities are entities
that can be occupied by other continuant [snap:Continuant] entities."^^xsd:string,
rdfs:comment "Comment: An instance of Site [snap:Site] is a mixture of independent
continuant [snap:IndependentContinuant] entities which act as surrounding
environments for other independent continuant [snap:IndependentContinuant]
entities, most importantly for instances of object [snap:Object]. A site [snap:Site]
is typically made of object [snap:Object] or fiat object part [snap:FiatObjectPart]
entities and a surrounding medium in which is found an object [snap:Object]
occupying the site [snap:Site]. Independent continuant [snap:IndependentContinuant]
entities may be associated with others (which, then, are site [snap:Site] entities)
through a relation of "occupation". That relation is connected to, but distinct from,
the relation of spatial location. Site [snap:Site] entities are not to be confused
with spatial region [snap:SpatialRegion] entities. In BFO, site [snap:Site] allows
for a so-called relational view of space which is different from the view
corresponding to the class spatial region [snap:SpatialRegion] (see the comment
on this class)."^^xsd:string,
rdfs:label "site"^^xsd:string,
rdfs:comment "Examples: a particular room in a particular hospital, Maria's nostril
or her intestines for a variety of bacteria."^^xsd:string

SubClassOf:

snap:IndependentContinuant

DisjointWith:

snap:ObjectAggregate,
snap:FiatObjectPart,
snap:ObjectBoundary,
snap:MaterialEntity,
snap:Object

Class: snap:Disposition

Annotations:

rdfs:comment "Definition: A realizable entity [snap:RealizableEntity] that essentially causes a specific process or transformation in the object [snap:Object] in which it inheres, under specific circumstances and in conjunction with the laws of nature. A general formula for dispositions is: X (object [snap:Object] has the disposition D to (transform, initiate a process) R under conditions C."^^xsd:string,
rdfs:comment "Examples: the disposition of vegetables to decay when not refrigerated, the disposition of a vase to break if dropped, the disposition of blood to coagulate, the disposition of a patient with a weakened immune system to contract disease, the disposition of metal to conduct electricity."^^xsd:string,
rdfs:label "disposition"^^xsd:string

SubClassOf:

snap:RealizableEntity

DisjointWith:

snap:Role,
snap:Function

Class: snap:ZeroDimensionalRegion

Annotations:

rdfs:comment "Definition: A spatial region [snap:SpatialRegion] with no dimensions."^^xsd:string,
rdfs:label "zero_dimensional_region"^^xsd:string,
rdfs:comment "Examples: a point"^^xsd:string

SubClassOf:

snap:SpatialRegion

DisjointWith:

snap:ThreeDimensionalRegion,
snap:TwoDimensionalRegion,
snap:OneDimensionalRegion

Class: snap:GenericallyDependentContinuant

Annotations:

rdfs:label "generically_dependent_continuant"^^xsd:string,
rdfs:comment "Examples: a certain PDF file that exists in different and in several hard drives"^^xsd:string,
rdfs:comment "Definition: A continuant [snap:Continuant] that is dependent on one or other independent continuant [snap:IndependentContinuant] bearers. For every instance of A requires some instance of (an independent continuant [snap:IndependentContinuant] type) B but which instance of B serves can change from time to time."^^xsd:string

SubClassOf:

snap:DependentContinuant

DisjointWith:

snap:SpecificallyDependentContinuant

Class: snap:IndependentContinuant

Annotations:

rdfs:comment "Examples: an organism, a heart, a leg, a person, a symphony orchestra, a chair, the bottom right portion of a human torso, the lawn and atmosphere in front of our building"^^xsd:string,
rdfs:comment "Definition: A continuant [snap:Continuant] that is a bearer of quality [snap:Quality] and realizable entity [snap:RealizableEntity] entities, in which other entities inhere and which itself cannot inhere in anything."
^^xsd:string,
rdfs:comment "Synonyms: substantial entity"^^xsd:string,
rdfs:label "independent_continuant"^^xsd:string

EquivalentTo:

snap:MaterialEntity
or snap:ObjectBoundary
or snap:Site

SubClassOf:

snap:Continuant

DisjointWith:

snap:SpatialRegion,
snap:DependentContinuant

Class: snap:FiatObjectPart

Annotations:

rdfs:label "fiat_object_part"^^xsd:string,
rdfs:comment "Synonyms: fiat substance part"^^xsd:string,
rdfs:comment "Definition: A material entity [snap:MaterialEntity] that is part of an object [snap:Object] but is not demarcated by any physical discontinuities."
^^xsd:string,
rdfs:comment "Examples: upper and lower lobes of the left lung, the dorsal and ventral surfaces of the body, the east side of Saarbruecken, the lower right portion of a human torso"^^xsd:string

SubClassOf:

snap:MaterialEntity

DisjointWith:

snap:Site,
snap:ObjectAggregate,
snap:ObjectBoundary,
snap:Object

Class: snap:DependentContinuant

Annotations:

rdfs:label "dependent_continuant"^^xsd:string,
rdfs:comment "Definition: A continuant [snap:Continuant] that is either dependent

on one or other independent continuant [snap:IndependentContinuant] bearers or inheres in or is borne by other entities."^^xsd:string

EquivalentTo:

 snap:GenericallyDependentContinuant
 or snap:SpecificallyDependentContinuant

SubClassOf:

 snap:Continuant

DisjointWith:

 snap:IndependentContinuant,
 snap:SpatialRegion

Class: span:SpatiotemporalRegion

Annotations:

 rdfs:comment "Comment: An instance of the spatiotemporal region [span:SpatiotemporalRegion] is a part of spacetime. All parts of spacetime are spatiotemporal region [span:SpatiotemporalRegion] entities and only spatiotemporal region [span:SpatiotemporalRegion] entities are parts of spacetime. In particular, neither spatial region [snap:SpatialRegion] entities nor temporal region [span:TemporalRegion] entities are in BFO parts of spacetime. Spacetime is the entire extent of the spatiotemporal universe, a designated individual, which is thus itself a spatiotemporal region [span:SpatiotemporalRegion]. Spacetime is among occurrents the analogous of space among continuant [snap:Continuant] entities."^^xsd:string,
 rdfs:label "spatiotemporal_region"^^xsd:string,
 rdfs:comment "Comment: Spacetime and spatiotemporal region [span:SpatiotemporalRegion] entities are entities in their own rights which exist independently of any entities which can be located at them. This view of spacetime can be called "absolutist" or "the container view". In BFO, the class processual context [span:ProcessualContext] allows for a so-called relational view of spacetime, that is to say, a view according to which spatiotemporality is a matter of relative location between entities and not a matter of being tied to spacetime. In BFO, the bridge between these two views is secured through the fact that instances of processual context [span:ProcessualContext] are too spatiotemporal entities."^^xsd:string,
 rdfs:comment "Examples: the spatiotemporal region occupied by a human life, the spatiotemporal region occupied by the development of a cancer tumor, the spatiotemporal context occupied by a process of cellular meiosis"^^xsd:string,
 rdfs:comment "Comment: All instances of occurrent [span:Occurrent] are spatiotemporal entities, that is, they enter in the relation of (spatiotemporal) location with spatiotemporal region [span:SpatiotemporalRegion] entities. As a particular case, the exact spatiotemporal location of a spatiotemporal region [span:SpatiotemporalRegion] is this region itself."^^xsd:string,
 rdfs:comment "Definition: An occurrent [span:Occurrent] at or in which processual entity [span:ProcessualEntity] entities can be located."^^xsd:string

EquivalentTo:

 span:ConnectedSpatiotemporalRegion
 or span:ScatteredSpatiotemporalRegion

SubClassOf:
span:Occurrent

DisjointWith:
span:ProcessualEntity,
span:TemporalRegion

Class: snap:OneDimensionalRegion

Annotations:
rdfs:comment "Definition: A spatial region [snap:SpatialRegion] with one dimension."^^xsd:string,
rdfs:comment "Examples: the part of space that is a line stretching from one end of absolute space to the other, an edge of a cube-shaped part of space"^^xsd:string,
rdfs:label "one_dimensional_region"^^xsd:string

SubClassOf:
snap:SpatialRegion

DisjointWith:
snap:ThreeDimensionalRegion,
snap:ZeroDimensionalRegion,
snap:TwoDimensionalRegion

Class: span:ScatteredSpatiotemporalRegion

Annotations:
rdfs:comment "Examples: the space and time occupied by the individual games of the World Cup, the space and time occupied by the individual liaisons in a romantic affair"^^xsd:string,
rdfs:comment "Definition: A spatiotemporal region [span:SpatiotemporalRegion] that has spatial and temporal dimensions and every spatial and temporal point of which is not connected with every other spatial and temporal point of which."^^xsd:string,
rdfs:label "scattered_spatiotemporal_region"^^xsd:string

SubClassOf:
span:SpatiotemporalRegion

DisjointWith:
span:ConnectedSpatiotemporalRegion

Class: snap:ThreeDimensionalRegion

Annotations:
rdfs:comment "Examples: a cube-shaped part of space, a sphere-shaped part of space"^^xsd:string,
rdfs:comment "Definition: A spatial region [snap:SpatialRegion] with three dimensions."^^xsd:string,
rdfs:label "three_dimensional_region"^^xsd:string

SubClassOf:
snap:SpatialRegion

DisjointWith:
snap:ZeroDimensionalRegion,
snap:TwoDimensionalRegion,
snap:OneDimensionalRegion

Class: snap:Quality

Annotations:
rdfs:label "quality"^^xsd:string,
rdfs:comment "Examples: the color of a tomato, the ambient temperature of air,
the circumference of a waist, the shape of a nose, the mass of a piece of gold,
the weight of a chimpanzee"^^xsd:string,
rdfs:comment "Definition: A specifically dependent continuant [snap:Specifically-
DependentContinuant] that is exhibited if it inheres in an entity or entities at all
(a categorical property)."^^xsd:string

SubClassOf:
snap:SpecificallyDependentContinuant

DisjointWith:
snap:RealizableEntity

Class: snap:Role

Annotations:
rdfs:comment "Examples: the role of a person as a surgeon, the role of a chemical
compound in an experiment, the role of a patient relative as defined by a hospital
administrative form, the role of a woman as a legal mother in the context of system
of laws, the role of a biological grandfather as legal guardian in the context of a
system of laws, the role of ingested matter in digestion, the role of a student in a
university"^^xsd:string,
rdfs:comment "Definition: A realizable entity [snap:RealizableEntity] the manifestation
of which brings about some result or end that is not essential to a continuant
[snap:Continuant] in virtue of the kind of thing that it is but that can be served or
participated in by that kind of continuant [snap:Continuant] in some kinds of natural,
social or institutional contexts."^^xsd:string,
rdfs:label "role"^^xsd:string

SubClassOf:
snap:RealizableEntity

DisjointWith:
snap:Disposition,
snap:Function

Class: span:FiatProcessPart

Annotations:

rdfs:comment "Definition: A processual entity [span:ProcessualEntity] that is part of a process but that does not have bona fide beginnings and endings corresponding to real discontinuities."^^xsd:string,
rdfs:comment "Examples: chewing during a meal, the middle part of a rainstorm, the worst part of a heart-attack, the most interesting part of Van Gogh's life"^^xsd:string,
rdfs:label "fiat_process_part"^^xsd:string

SubClassOf:

span:ProcessualEntity

DisjointWith:

span:ProcessAggregate,
span:ProcessBoundary,
span:Process,
span:ProcessualContext

Class: span:TemporalInstant

Annotations:

rdfs:comment "Definition: A connected temporal region [span:ConnectedTemporalRegion] comprising a single moment of time."^^xsd:string,
rdfs:label "temporal_instant"^^xsd:string,
rdfs:comment "Examples: right now, the moment at which a finger is detached in an industrial accident, the moment at which a child is born, the moment of death"^^xsd:string

SubClassOf:

span:ConnectedTemporalRegion

DisjointWith:

span:TemporalInterval

Class: snap:SpatialRegion

Annotations:

rdfs:comment "Comment: Space and spatial region [snap:SpatialRegion] entities are entities in their own rights which exist independently of any entities which can be located at them. This view of space is sometimes called "absolutist" or "the container view". In BFO, the class site [snap:Site] allows for a so-called relational view of space, that is to say, a view according to which spatiality is a matter of relative location between entities and not a matter of being tied to space. The bridge between these two views is secured through the fact that while instances of site [snap:Site] are not spatial region [snap:SpatialRegion] entities, they are nevertheless spatial entities."^^xsd:string,
rdfs:comment "Comment: All instances of continuant [snap:Continuant] are spatial entities, that is, they enter in the relation of (spatial) location with spatial region [snap:SpatialRegion] entities. As a particular case, the exact spatial location of a spatial region [snap:SpatialRegion] is this region itself."^^xsd:string,
rdfs:label "spatial_region"^^xsd:string,
rdfs:comment "Examples: the sum total of all space in the universe, parts of the sum total of all space in the universe"^^xsd:string,
rdfs:comment "Definition: A continuant [snap:Continuant] that is neither bearer of quality [snap:Quality] entities nor inheres in any other entities."^^xsd:string,

rdfs:comment "Comment: An instance of spatial region [snap:SpatialRegion] is a part of space. All parts of space are spatial region [snap:SpatialRegion] entities and only spatial region [snap:SpatialRegion] entities are parts of space. Space is the entire extent of the spatial universe, a designated individual, which is thus itself a spatial region [snap:SpatialRegion]."^^xsd:string

EquivalentTo:

 snap:OneDimensionalRegion
 or snap:ThreeDimensionalRegion
 or snap:TwoDimensionalRegion
 or snap:ZeroDimensionalRegion

SubClassOf:

 snap:Continuant

DisjointWith:

 snap:IndependentContinuant,
 snap:DependentContinuant

Class: snap:Function

Annotations:

 rdfs:label "function"^^xsd:string,
 rdfs:comment "Definition: A realizable entity [snap:RealizableEntity] the manifestation of which is an essentially end-directed activity of a continuant [snap:Continuant] entity in virtue of that continuant [snap:Continuant] entity being a specific kind of entity in the kind or kinds of contexts that it is made for."^^xsd:string,
 rdfs:comment "Examples: the function of a birth canal to enable transport, the function of the heart in the body: to pump blood, to receive de-oxygenated and oxygenated blood, etc., the function of reproduction in the transmission of genetic material, the digestive function of the stomach to nutriate the body, the function of a hammer to drive in nails, the function of a computer program to compute mathematical equations, the function of an automobile to provide transportation, the function of a judge in a court of law"^^xsd:string

SubClassOf:

 snap:RealizableEntity

DisjointWith:

 snap:Disposition,
 snap:Role

References

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- [2] B. Smith, "Beyond concepts, or: Ontology as reality representation," in *Formal Ontology and Information Systems. Proceedings of the Third International Conference (FOIS 2004)*, A. Varzi and L. Vieu, Eds. Amsterdam: IOS Press, 2004, pp. 73-84.
- [3] B. Smith and P. Grenon, "The cornucopia of formal-ontological relations," *Dialectica*, vol. 58, no. 3, pp. 279-296, 2004.