BFO 2020 Continuant Mereology Axioms

Continuant part of and has continuant part are inverse relations [eld-1]

$\forall t,a,b\,(\text{continuantPartOf}(a,b,t) \leftrightarrow \text{hasContinuantPart}(b,a,t))$

Continuant part of is reflexive at a time [mcd-1]

$\forall a,t\,(\text{instanceOf}(a,\text{independentContinuant},t) \rightarrow \text{continuantPartOf}(a,a,t))$

Proper continuant part of and has proper continuant part are inverse relations [hpm-1]

$\forall t,a,b\,(\text{properContinuantPartOf}(a,b,t) \leftrightarrow \text{hasProperContinuantPart}(b,a,t))$

Exists at is dissective on first argumentwhen it is a continuant [uns-1]

$\forall p,q,r\,(\text{existsAt}(p,q) \wedge \text{continuantPartOf}(r,p,q) \rightarrow \text{existsAt}(r,q))$

A fiat point has no parts other than itself [jgo-1]

$\forall fp,t,p\,(\text{instanceOf}(fp,\text{fiatPoint},t) \wedge \text{continuantPartOf}(p,fp,t) \rightarrow p=fp)$

Continuant part of is dissective on third argument, a temporal region [mqp-1]

$\forall p,q,r,s\,(\text{continuantPartOf}(p,q,r) \wedge \text{temporalPartOf}(s,r) \rightarrow \text{continuantPartOf}(p,q,s))$

If a has continuant part b then if a is an instance of fiat point then b is an instance of fiat point [jqd-1]

$\forall p,q,t\,(\text{hasContinuantPart}(p,q,t) \wedge \text{instanceOf}(p,\text{fiatPoint},t) \rightarrow \text{instanceOf}(q,\text{fiatPoint},t))$

X proper continuant part of y means x is a continuant part of y but y is not continuant part of x [sls-1]

$\forall x,y,t\,(\text{properContinuantPartOf}(x,y,t)$
$\quad \leftrightarrow \text{continuantPartOf}(x,y,t) \wedge \neg\text{continuantPartOf}(y,x,t))$

Proper continuant part of is dissective on third argument, a temporal region [vjv-1]

$\forall p,q,r,s\,(\text{properContinuantPartOf}(p,q,r) \wedge \text{temporalPartOf}(s,r)$
$\quad \rightarrow \text{properContinuantPartOf}(p,q,s))$

If a continuant part of b then if a is an instance of material entity then b is an instance of material entity [dok-1]

$\forall p,q,t\,(\text{continuantPartOf}(p,q,t) \wedge \text{instanceOf}(p,\text{materialEntity},t)$
$\quad \rightarrow \text{instanceOf}(q,\text{materialEntity},t))$

If a continuant part of b then if a is an instance of spatial region then b is an instance of spatial region, and vice versa [kbr-1]

$\forall p,q,t\,(\text{continuantPartOf}(p,q,t)$
$\quad \rightarrow (\text{instanceOf}(p,\text{spatialRegion},t) \leftrightarrow \text{instanceOf}(q,\text{spatialRegion},t)))$

If a has continuant part b then if a is an instance of fiat surface then b is an instance of continuant fiat boundary [ysp-1]

$\forall p,q,t\,(\text{hasContinuantPart}(p,q,t) \wedge \text{instanceOf}(p,\text{fiatSurface},t)$
$\quad \rightarrow \text{instanceOf}(q,\text{continuantFiatBoundary},t))$

If a has continuant part b then if a is an instance of three dimensional spatial region then b is an instance of spatial region [fzg-1]

$\forall p,q,t\,(\text{hasContinuantPart}(p,q,t) \wedge \text{instanceOf}(p,\text{threeDimensionalSpatialRegion},t)$
$\quad \rightarrow \text{instanceOf}(q,\text{spatialRegion},t))$

If a has continuant part b then if a is an instance of continuant fiat boundary then b is an instance of continuant fiat boundary [ixo-1]

$\forall p,q,t\,(\text{hasContinuantPart}(p,q,t) \wedge \text{instanceOf}(p,\text{continuantFiatBoundary},t)$
$\quad \rightarrow \text{instanceOf}(q,\text{continuantFiatBoundary},t))$

If a continuant part of b then if a is an instance of site then b is an instance of site or material entity [izr-1]

$\forall p,q,t\,(\text{continuantPartOf}(p,q,t) \wedge \text{instanceOf}(p,\text{site},t)$
$\quad \rightarrow \text{instanceOf}(q,\text{site},t) \vee \text{instanceOf}(q,\text{materialEntity},t))$

If a continuant part of b then if a is an instance of independent continuant then b is an instance of independent continuant, and vice versa [cez-1]

$\forall p,q,t\,(\text{continuantPartOf}(p,q,t)$
$\quad \rightarrow (\text{instanceOf}(p,\text{independentContinuant},t) \leftrightarrow \text{instanceOf}(q,\text{independentContinuant},t)))$

Continuant part of is transitive at a time [plp-1]

$\forall$a,b,c,t,t2 (continuantPartOf(a,b,t) $\wedge$ continuantPartOf(b,c,t2) $\wedge$ temporalPartOf(t,t2)
$\rightarrow$ continuantPartOf(a,c,t))

Continuant part of is time indexed and has domain: continuant and range: continuant [bdd-1]

$\forall$a,b,t (continuantPartOf(a,b,t)
$\rightarrow$ instanceOf(a,continuant,t) $\wedge$ instanceOf(b,continuant,t)
$\wedge$ instanceOf(t,temporalRegion,t))

If a has continuant part b then if a is an instance of fiat line then b is an instance of fiat line or fiat point [cwp-1]

$\forall$p,q,t (hasContinuantPart(p,q,t) $\wedge$ instanceOf(p,fiatLine,t)
$\rightarrow$ instanceOf(q,fiatLine,t) $\vee$ instanceOf(q,fiatPoint,t))

If a has continuant part b then if a is an instance of site then b is an instance of site or continuant fiat boundary [mjj-1]

$\forall$p,q,t (hasContinuantPart(p,q,t) $\wedge$ instanceOf(p,site,t)
$\rightarrow$ instanceOf(q,site,t) $\vee$ instanceOf(q,continuantFiatBoundary,t))

Proper continuant part of is time indexed and has domain: continuant and range: continuant [kte-1]

$\forall$a,b,t (properContinuantPartOf(a,b,t)
$\rightarrow$ instanceOf(a,continuant,t) $\wedge$ instanceOf(b,continuant,t)
$\wedge$ instanceOf(t,temporalRegion,t))

If a has continuant part b then if a is an instance of zero dimensional spatial region then b is an instance of zero dimensional spatial region [bfv-1]

$\forall$p,q,t (hasContinuantPart(p,q,t) $\wedge$ instanceOf(p,zeroDimensionalSpatialRegion,t)
$\rightarrow$ instanceOf(q,zeroDimensionalSpatialRegion,t))

Proper continuant part of is transitive at a time [xpg-1]

$\forall$a,b,c,t,t2 (properContinuantPartOf(a,b,t) $\wedge$ properContinuantPartOf(b,c,t2)
$\wedge$ temporalPartOf(t,t2)
$\rightarrow$ properContinuantPartOf(a,c,t))

A fiat line occupies a one dimensional spatial region [kcq-1]

$\forall$x,t (instanceOf(x,fiatLine,t)
$\rightarrow \exists$s,tp (temporalPartOf(tp,t) $\wedge$ occupiesSpatialRegion(x,s,tp)
$\wedge$ instanceOf(s,oneDimensionalSpatialRegion,tp)))

A fiat point occupies a zero dimensional spatial region [alm-1]

$\forall$x,t (instanceOf(x,fiatPoint,t)
$\rightarrow \exists$ tp,s (temporalPartOf(tp,t) $\wedge$ occupiesSpatialRegion(x,s,tp)
$\wedge$ instanceOf(s,zeroDimensionalSpatialRegion,tp)))

A fiat surface occupies a two dimensional spatial region [fpl-1]

$\forall$x,t (instanceOf(x,fiatSurface,t)
$\rightarrow \exists$s,tp (temporalPartOf(tp,t) $\wedge$ occupiesSpatialRegion(x,s,tp)
$\wedge$ instanceOf(s,twoDimensionalSpatialRegion,tp)))

If a has continuant part b then if a is an instance of material entity then b is an instance of site or continuant fiat boundary or material entity [mic-1]

$\forall$p,q,t (hasContinuantPart(p,q,t) $\wedge$ instanceOf(p,materialEntity,t)
$\rightarrow$ instanceOf(q,site,t) $\vee$ instanceOf(q,continuantFiatBoundary,t)
$\vee$ instanceOf(q,materialEntity,t))

If a has continuant part b then if a is an instance of one dimensional spatial region then b is an instance of one dimensional spatial region or zero dimensional spatial region [wne-1]

$\forall$p,q,t (hasContinuantPart(p,q,t) $\wedge$ instanceOf(p,oneDimensionalSpatialRegion,t)
$\rightarrow$ instanceOf(q,oneDimensionalSpatialRegion,t)
$\vee$ instanceOf(q,zeroDimensionalSpatialRegion,t))

If at all times that two object aggreates exist each is part of the other, then they are identical [glc-1]

$\forall$a,b ((($\exists$t (instanceOf(a,objectAggregate,t) $\wedge$ continuantPartOf(a,b,t)
$\wedge$ continuantPartOf(b,a,t)))
$\wedge$ ($\forall$t (continuantPartOf(a,b,t) $\leftrightarrow$ continuantPartOf(b,a,t)))
$\rightarrow$ a=b)

The dimensionality of the region of something occupying a one dimensional spatial region does not change [qfe-1]

$\forall$m,s ($\exists$t (occupiesSpatialRegion(m,s,t) $\wedge$ instanceOf(s,oneDimensionalSpatialRegion,t))
$\rightarrow \forall$t1,s1 (occupiesSpatialRegion(m,s1,t1)
$\rightarrow$ instanceOf(s1,oneDimensionalSpatialRegion,t1)))

The dimensionality of the region of something occupying a two dimensional spatial region does not change [dor-1]

$\forall$ m,s ($\exists$ t (occupiesSpatialRegion(m,s,t) $\wedge$ instanceOf(s,twoDimensionalSpatialRegion,t))
$\rightarrow \forall$ t1,s1 (occupiesSpatialRegion(m,s1,t1)
$\rightarrow$ instanceOf(s1,twoDimensionalSpatialRegion,t1)))

The dimensionality of the region of something occupying a zero dimensional spatial region does not change [fok-1]

$\forall$ m,s ($\exists$ t (occupiesSpatialRegion(m,s,t) $\wedge$ instanceOf(s,zeroDimensionalSpatialRegion,t))
$\rightarrow \forall$ t1,s1 (occupiesSpatialRegion(m,s1,t1)
$\rightarrow$ instanceOf(s1,zeroDimensionalSpatialRegion,t1)))

The dimensionality of the region of something occupying a three dimensional spatial region does not change [rlf-1]

$\forall$ m,s ($\exists$ t (occupiesSpatialRegion(m,s,t) $\wedge$ instanceOf(s,threeDimensionalSpatialRegion,t))
$\rightarrow \forall$ t1,s1 (occupiesSpatialRegion(m,s1,t1)
$\rightarrow$ instanceOf(s1,threeDimensionalSpatialRegion,t1)))

If a material entity has a proper part, then at least one of its proper parts is not an immaterial entity [adm-1]

$\forall$ m,t (instanceOf(m,materialEntity,t) $\wedge$ ($\exists$ mp (continuantPartOf(mp,m,t) $\wedge$ mp$\neq$m))
$\rightarrow \exists$ mp (mp$\neq$m $\wedge$ continuantPartOf(mp,m,t) $\wedge \neg$ instanceOf(mp,immaterialEntity,t)))

If a has continuant part b then if a is an instance of two dimensional spatial region then b is an instance of two dimensional spatial region or one dimensional spatial region or zero dimensional spatial region [hbn-1]

$\forall$ p,q,t (hasContinuantPart(p,q,t) $\wedge$ instanceOf(p,twoDimensionalSpatialRegion,t)
$\rightarrow$ instanceOf(q,twoDimensionalSpatialRegion,t)
$\vee$ instanceOf(q,oneDimensionalSpatialRegion,t)
$\vee$ instanceOf(q,zeroDimensionalSpatialRegion,t))

If at any time that two non object aggreates exist each is part of the other, then they are identical [tab-1]

$\forall$ a,b ($\exists$ t (instanceOf(a,independentContinuant,t) $\wedge \neg$ instanceOf(a,objectAggregate,t)
$\wedge$ instanceOf(b,independentContinuant,t) $\wedge \neg$ instanceOf(b,objectAggregate,t)
$\wedge$ continuantPartOf(a,b,t) $\wedge$ continuantPartOf(b,a,t))
$\rightarrow$ a=b)

Continuant part of has weak supplementation [fyf-1]

$\forall$ t,x,y (instanceOf(x,continuant,t) $\wedge$ instanceOf(y,continuant,t)
$\wedge$ instanceOf(t,temporalRegion,t)
$\rightarrow$ (continuantPartOf(x,y,t) $\wedge$ x$\neq$y
$\rightarrow \exists$ z (instanceOf(z,continuant,t) $\wedge$ continuantPartOf(z,y,t) $\wedge$ z$\neq$y
$\wedge \neg$ ($\exists$ overlap (instanceOf(overlap,continuant,t)
$\wedge$ continuantPartOf(overlap,x,t)
$\wedge$ continuantPartOf(overlap,z,t))))))

Continuant part of has a unique product at a time [gzr-1]

$\forall$ x,y,t (instanceOf(x,continuant,t) $\wedge$ instanceOf(y,continuant,t)
$\wedge$ instanceOf(t,temporalRegion,t)
$\rightarrow$ ($\exists$ overlap (instanceOf(overlap,continuant,t) $\wedge$ continuantPartOf(overlap,x,t)
$\wedge$ continuantPartOf(overlap,y,t))
$\rightarrow \exists$ overlap (instanceOf(overlap,continuant,t)
$\wedge$ ($\forall$ w (instanceOf(w,continuant,t)
$\rightarrow$ (continuantPartOf(w,overlap,t)
$\leftrightarrow$ continuantPartOf(w,x,t) $\wedge$ continuantPartOf(w,y,t)))))))

Alan Ruttenberg, January 8, 2024. The most recent version of this file will always be in the GitHub repository https://github.com/bfo-ontology/bfo-2020