BFO 2020 Specific Dependency Axioms

Inheres in and bearer of are inverse relations [dzz-1]

$$\forall a,b\,(\text{inheresIn}(a,b) \leftrightarrow \text{bearerOf}(b,a))$$

Realizes and has realization are inverse relations [pvk-1]

$$\forall a,b\,(\text{realizes}(a,b) \leftrightarrow \text{hasRealization}(b,a))$$

Has material basis and material basis of are inverse relations [tla-1]

$$\forall t,a,b\,(\text{hasMaterialBasis}(a,b,t) \leftrightarrow \text{materialBasisOf}(b,a,t))$$

Specifically depends on and specifically depended on by are inverse relations [yct-1]

$$\forall a,b\,(\text{specificallyDependsOn}(a,b) \leftrightarrow \text{specificallyDependedOnBy}(b,a))$$

When a role is realized the bearer of the role participates in the realization process [grx-1]

$$\forall r,p,b\,(\text{realizes}(p,r) \wedge \text{inheresIn}(r,b) \rightarrow \exists t\,\text{participatesIn}(b,p,t))$$

Has material basis is dissective on third argument, a temporal region [hnl-1]

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

Realizes has domain process and range realizable entity [oot-1]

$$\forall a,b\,(\text{realizes}(a,b) \rightarrow \exists t\,\text{instanceOf}(a,\text{process},t) \wedge \exists t\,\text{instanceOf}(b,\text{realizableEntity},t))$$

Specifically depends on is transitive [myu-1]

$$\forall a,b,c\,(\text{specificallyDependsOn}(a,b) \wedge \text{specificallyDependsOn}(b,c) \wedge a \neq c \rightarrow \text{specificallyDependsOn}(a,c))$$

If s s depends_on c then s and c never share common parts (s,c continuants) [nfe-1]

$$\forall s,c\,(\text{specificallyDependsOn}(s,c) \rightarrow \neg(\exists w,t\,(\text{continuantPartOf}(w,s,t) \wedge \text{continuantPartOf}(w,c,t))))$$

A realizable entity exists at least at the beginning of the realization process [vhg-1]

$$\forall r,p\,(\text{realizes}(p,r) \rightarrow \exists \text{proct},\text{first}\,(\text{occupiesTemporalRegion}(p,\text{proct}) \wedge \text{hasFirstInstant}(\text{proct},\text{first}) \wedge \text{existsAt}(r,\text{first})))$$

Has material basis is time indexed and has domain: disposition and range: material entity [cfs-1]

$$\forall a,b,t\,(\text{hasMaterialBasis}(a,b,t) \rightarrow \text{instanceOf}(a,\text{disposition},t) \wedge \text{instanceOf}(b,\text{materialEntity},t) \wedge \text{instanceOf}(t,\text{temporalRegion},t))$$

If x s depends on y then there's at least one time when they both exist [iyu-1]

$$\forall s,c\,(\text{specificallyDependsOn}(s,c) \rightarrow (\exists t\,(\text{existsAt}(s,t) \wedge \text{existsAt}(c,t))) \wedge (\forall t\,(\text{existsAt}(s,t) \rightarrow \text{existsAt}(c,t))))$$

DEFINITION: b is a relational quality = Def. b is a quality and there exists distinct c and d such that at all times t, b inheres in c if and only b specifically depends on. [dbp-1]

$$\forall b\,(\exists t\,\text{instanceOf}(b,\text{relationalQuality},t) \leftrightarrow (\exists c,d\,(c \neq d \wedge \text{inheresIn}(b,c) \wedge \text{specificallyDependsOn}(b,d))) \wedge \exists t\,\text{instanceOf}(b,\text{quality},t))$$

Inheres in has domain specifically dependent continuant and range independent continuant but not spatial region [lmq-1]

$$\forall a,b\,(\text{inheresIn}(a,b) \rightarrow \exists t\,\text{instanceOf}(a,\text{specificallyDependentContinuant},t) \wedge (\exists t\,(\text{instanceOf}(b,\text{independentContinuant},t) \wedge \neg\text{instanceOf}(b,\text{spatialRegion},t))))$$

A inheres_in b =Def. a is a specifically dependent continuant and b is an independent continuant that is not a spatial region and a s depends_on b. [tht-1]

$$\forall a,b\,(\text{inheresIn}(a,b) \leftrightarrow \text{specificallyDependsOn}(a,b) \wedge (\exists t\,(\text{instanceOf}(a,\text{specificallyDependentContinuant},t) \wedge \text{instanceOf}(b,\text{independentContinuant},t) \wedge \neg\text{instanceOf}(b,\text{spatialRegion},t))))$$

Definition of specifically dependent continuant. [akq-1]

$$\forall s\,(\exists t\,\mathrm{instanceOf}(s,\mathrm{specificallyDependentContinuant},t) \leftrightarrow \exists c,t\,(\mathrm{instanceOf}(s,\mathrm{continuant},t) \wedge \mathrm{instanceOf}(c,\mathrm{independentContinuant},t) \wedge \neg\mathrm{instanceOf}(c,\mathrm{spatialRegion},t) \wedge \mathrm{specificallyDependsOn}(s,c)))$$

The material basis of a disposition is part of the bearer of the disposition [uxo-1]

$$\forall m,d,b\,(\exists t\,\mathrm{instanceOf}(m,\mathrm{materialEntity},t) \wedge \exists t\,\mathrm{instanceOf}(d,\mathrm{disposition},t) \wedge \exists t\,\mathrm{instanceOf}(b,\mathrm{materialEntity},t) \wedge \mathrm{inheresIn}(d,b) \rightarrow \forall t\,(\mathrm{hasMaterialBasis}(d,m,t) \rightarrow \mathrm{continuantPartOf}(m,b,t)))$$

Specifically depends on has domain specifically dependent continuant and range specifically dependent continuant or independent continuant but not spatial region [kkl-1]

$$\forall a,b\,(\mathrm{specificallyDependsOn}(a,b) \rightarrow \exists t\,\mathrm{instanceOf}(a,\mathrm{specificallyDependentContinuant},t) \wedge (\exists t\,(\mathrm{instanceOf}(b,\mathrm{specificallyDependentContinuant},t) \vee (\mathrm{instanceOf}(b,\mathrm{independentContinuant},t) \wedge \neg\mathrm{instanceOf}(b,\mathrm{spatialRegion},t)))))$$

At every time a specific dependent s participates in a process p there's a part of that time, during which there's an independent continuant that s s depends on, and that participates in p at that time [cgn-1]

$$\forall \mathrm{sdc},p,t\,(\mathrm{instanceOf}(\mathrm{sdc},\mathrm{specificallyDependentContinuant},t) \wedge \mathrm{participatesIn}(\mathrm{sdc},p,t) \rightarrow \exists \mathrm{tp},\mathrm{ic}\,(\mathrm{instanceOf}(\mathrm{tp},\mathrm{temporalRegion},\mathrm{tp}) \wedge \mathrm{temporalPartOf}(\mathrm{tp},t) \wedge \mathrm{instanceOf}(\mathrm{ic},\mathrm{independentContinuant},\mathrm{tp}) \wedge \neg\mathrm{instanceOf}(\mathrm{ic},\mathrm{spatialRegion},\mathrm{tp}) \wedge \mathrm{specificallyDependsOn}(\mathrm{sdc},\mathrm{ic}) \wedge \mathrm{participatesIn}(\mathrm{ic},p,\mathrm{tp})))$$

Alan Ruttenberg, November 12, 2021. The most recent version of this file will always be in the GitHub repository https://github.com/bfo-ontology/bfo-2020