

# BFO 2020 Participation Axioms

(1) Participates in is time indexed and has domain: independent continuant but not spatial region or specifically dependent continuant or generically dependent continuant and range: process

$$\begin{aligned} &\forall a,b,t (\text{participatesIn}(a,b,t) \\ &\rightarrow ((\text{instanceOf}(a,\text{independentContinuant},t) \wedge \neg \text{instanceOf}(a,\text{spatialRegion},t)) \\ &\quad \vee \text{instanceOf}(a,\text{specificallyDependentContinuant},t) \\ &\quad \vee \text{instanceOf}(a,\text{genericallyDependentContinuant},t)) \\ &\quad \wedge \text{instanceOf}(b,\text{process},t) \wedge \text{instanceOf}(t,\text{temporalRegion},t)) \end{aligned}$$

(2) If b has participant c at t then b and c exists at t

$$\forall p,t (\text{instanceOf}(p,\text{process},t) \rightarrow \exists c \text{ participatesIn}(c,p,t))$$

(3) If a generically dependent continuant participates in a process p then, if it is concretized as a process, that process is part of p, and if concretized as an sdc then the bearer of that sdc participates in the process

$$\begin{aligned} &\forall gdc,p,t (\text{instanceOf}(gdc,\text{genericallyDependentContinuant},t) \wedge \text{participatesIn}(gdc,p,t) \\ &\rightarrow \exists tp,b (\text{temporalPartOf}(tp,t) \wedge \text{concretizes}(b,gdc,tp) \\ &\quad \wedge ((\text{instanceOf}(b,\text{specificallyDependentContinuant},tp) \\ &\quad \wedge (\exists ic (\text{specificallyDependsOn}(b,ic) \wedge \text{participatesIn}(ic,p,tp)))) \\ &\quad \vee (\text{occurrentPartOf}(b,p) \wedge \text{existsAt}(b,tp)))))) \end{aligned}$$

(4) Participates in is disjunctive on third argument, a temporal region

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

(5) Participates in and has participant are inverse relations

$$\forall t,a,b (\text{participatesIn}(a,b,t) \leftrightarrow \text{hasParticipant}(b,a,t))$$

(6) 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 depends on, and that participates in p at that time

$$\begin{aligned} &\forall sdc,p,t (\text{instanceOf}(sdc,\text{specificallyDependentContinuant},t) \wedge \text{participatesIn}(sdc,p,t) \\ &\rightarrow \exists tp,ic (\text{instanceOf}(tp,\text{temporalRegion},tp) \\ &\quad \wedge \text{instanceOf}(ic,\text{independentContinuant},tp) \\ &\quad \wedge \neg \text{instanceOf}(ic,\text{spatialRegion},tp) \wedge \text{specificallyDependsOn}(sdc,ic) \\ &\quad \wedge \text{participatesIn}(ic,p,tp)) \end{aligned}$$