

Two Formal Systems for Situation Semantics

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Abstract We are going to present two formal systems intended to capture some of the basic features of Barwise and Perry's situation semantics. The first one is a multidimensional system which allows formal counterparts of situations (including incoherent ones), the relational theory of meaning, and the strong consequence relation. Our second system is an extension of the former one and considers a set of actual situations, so that the notion of constraint can be expressed in it. Soundness, completeness, and compactness will be proven for both systems.

1 The language $\mathbb{L}$ First of all, we introduce the language $\mathbb{L}$ and its semantics. $\mathbb{L}$ has the following symbols:

Binary connectives: $\wedge, \rightarrow, |$.

Quantifier: $\forall$.

Unary connectives: $\neg, \otimes_i$, for each natural number i .

Identity symbol: $=$.

We also have denumerable sets of predicate letters, constants and variables. All the wffs of $\mathbb{L}$ are closed formulas and are defined in the usual way.

The models for $\mathbb{L}$ are structures $N = \langle W, U, D, \llbracket \cdot \rrbracket, S \rangle$, where W and U are sets, $W \neq \emptyset$, and D is a function defined on W such that for each $v \in W$ $D(v) \subseteq U$. $\llbracket \cdot \rrbracket$ is a function assigning a value $\llbracket c \rrbracket \in U$ to every constant c . S is a function such that for each $v \in W$, $S(v)$ is a set of U -formulas of the form $Pr_1 \dots r_n$ or $\neg Pr_1 \dots r_n$, where $r_i \in U$, for $1 \leq i \leq n$. (We are using the concept of U -formula in the same way it is used in Smullyan [9].) We also require that whenever $(\neg)Pr_1 \dots r_n \in S(u_i)$, $r_1 \dots r_n \in D(u_i)$. (We use $(\neg)A$ to represent either A or $\neg A$. Obviously, when $(\neg)A$ appears more than once in the same context, all its occurrences should be interpreted in the same way.)

Each element v of W has an associated set $S(v)$ of atomic U -formulas or negations of atomic U -formulas. $S(v)$ can be considered as a set of positive and

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