ABSTRACT. The paper presents a formal explication of the early Wittgenstein's views on ontology, the syntax and semantics of an ideal logical language, and the propositional attitudes. It will be shown that Wittgenstein gave a "language of thought" analysis of propositional attitude ascriptions, and that his ontological views imply that such ascriptions are truth-functions of (and supervenient upon) elementary sentences. Finally, an axiomatization of a quantified doxastic modal logic corresponding to Tractarian semantics will be given.

Historically, Wittgenstein's *Tractatus* is primarily a forerunner of Tarski's and Carnap's later work on semantics. However, the latter do not faithfully reflect Wittgenstein's ideas: for example, Wittgenstein's idea that predicates are names of properties is absent from Tarski's work, while Carnap's "state-descriptions" are certainly not descriptions of states of affairs in the Tractarian sense (cf. Section III below). Therefore the question arises: is it possible to develop a semantical system which is both faithful to the *Tractatus* and as precise as Tarski's and Carnap's contributions? This is the question which we shall try to answer in the present paper. The effort will be rewarding: not only will it turn out that it is indeed possible to give a formal reconstruction, it will moreover appear that such a reconstruction has various features which are still interesting today. Thus, it not only yields a truth-functional analysis of quantification, modalities and propositional attitude ascriptions, it also shows the *Tractatus* to contain a quite modern language of thought theory and even a variant of the currently popular doctrine of psychophysical supervenience.

Our formal reconstruction of the *Tractatus* is not the first one to appear. As early as 1966, Stegmüller – condemning the average interpretation of the *Tractatus* as nothing but "a bunch of very unclear statements, which should first be explicated themselves" – gave a formalization of the picture theory; shortly after, Suszko (1968), Wolniewicz (1968), and Mudersbach (1968) began to formalize Tractarian ontology. The formal approach has been taken up by perhaps a dozen philosophers since then. However, none of the previous contributions is wholly successful. First, none of them gives a
comprehensive formalization of both object ontology and situation ontology and semantics; as a result, the interrelations between such subjects as the independence of states of affairs, the describability of the world by elementary sentences and the principle of truth-functionality have remained unclear. Second, propositional attitude ascriptions have never been discussed in formal terms before, let alone their truth-functionality or the question of their definability in terms of elementary sentences. Finally, all previous reconstructions are rather inelegant. The present reconstruction certainly avoids the first two defects; we hope it avoids the third too.

The plan of the paper is as follows. Because of the primacy of the ontological in the *Tractatus*, we start with this subject in Section I. Section II discusses the syntax and Section III the semantics of sentences and pictures; the propositional attitudes are treated separately in Section IV. Section V presents the logical system the preceding results lead up to. Finally, the moral will be drawn in Section VI. Comparisons with earlier formalizations will continually be made as we go along.

I. THE ONTOLOGY OF THE *TRACTATUS*

I.1. Objects and states of affairs

To Wittgenstein, “objects” (*Gegenstände*) are the basic building-blocks of the world. They are the “substance of the world” (TLP 2.021 ff.); all possible worlds have the same substance (TLP 2.022, 2.023, 2.024). The number of objects cannot be determined a priori; “it is a matter of physics to find out” (NB p. 127). However, Wittgenstein assumes the existence of at least one object (TLP 2.0211–2.0212, 2.026, 4.2211); on the other hand, he never refers to more than \( \aleph_0 \) objects (TLP 4.1272; NB p. 127). Denoting the set of objects (*Gegenstände*) by “\( G \)”, we therefore stipulate:

**DEFINITION 1.** Let \( G \) be a set such that \( 1 \leq \text{Card}(G) \leq \aleph_0 \).

It is important to realize that the category of “objects” is a very general one. Relations and properties, if there are such things, are objects too: “Auch Relationen und Eigenschaften etc., sind *Gegenstände*” (NB 16.6.15). (This is Wittgenstein’s so-called “realism” about