

Łukasiewicz's contribution to possible worlds semantics

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On the first sight, it could sound strange that Łukasiewicz could have something in common with possible worlds semantics as his system of modal logic did not require this type of semantics. In the Church's (1951, 229–230) distinction:

Advocates of modality may meet it either by rejecting the principle of bivalence or by distinguishing between variables having truth-values as their values (to which the principle of bivalence is applicable) and variables having propositions as their values (to which the connective or "functor" M is applicable).

Łukasiewicz was undoubtedly an advocate of the first option, while proponents of possible worlds semantics might be representatives of the second option. Nonetheless, my aim is to show that Łukasiewicz's influence played a crucial role in the development of C. A. Meredith's systems of modal logic. Meredith together with Arthur N. Prior proposed U-calculus in their joint paper "Interpretations of Different Modal Logics in the 'Property Calculus'" from 1956. This might be the first calculus of modal logic in which appeared both essential features of possible worlds semantics, the quantification over possibilities and the relation of accessibility between possible worlds (see Copeland 2006, 373).

The property calculus that Meredith proposed was based on class calculus that Mordchaj Wajsberg developed in 1933. Wajsberg (1977) demonstrated that his class calculus could be semantic characterisation of C. I. Lewis' system of strict implication. As Meredith's system of modal logic is a combination of Łukasiewicz's four-valued logic and Lewis' S5, he benefited from Wajsberg's work (see Meredith, Prior 1965, 99). It is, however, doubtful whether Meredith himself interpreted U-calculus in a way Prior (1962a, 36; 1962b, 140) later did and consequently if he endeavoured for possible worlds semantics (see Rybaříková, Hasle 2017, 50–54). On the contrary, it could be clearly demonstrated that Meredith's system of modal logic and the property calculus were affected by Łukasiewicz. Consequently, although neither Łukasiewicz's nor Meredith's systems of modal logic require possible worlds semantics, their work led to the system of logic that is a direct predecessor of possible worlds semantics.

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