

# Arthur N. Prior and Leśniewski's Concept of Names: Why Prior Adopted It and Why He Left It in His Temporal Ontology

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## Abstract

For a certain period, the concept of names that Stanisław Leśniewski and his followers developed had a certain impact on the concept that appeared in Arthur Prior's temporal ontology. However, this impact seemed to vanish in time. The aim of this paper is to present why Prior was interested in Leśniewski's concept of names and quantification and to discuss why in Prior's later works Leśniewski's influence is not as apparent as it was in the first works on temporal logic. Namely, the paper suggests three possible solutions; the differences that were between Prior and Leśniewski's views on time and determinism, new concepts of names that occurred at that time, and Leśniewski's extensionalism that opposed Prior's preference for intensional logic.

**Keywords:** Arthur Prior, Stanisław Leśniewski, concept of names, quantification, temporal logic, extensionality, intensionality.

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# 1 Introduction

The history of analytic philosophy contains several renowned and widely acknowledged figures such as Frege, Russell, Carnap, and Quine. They are philosophers who built the mainstream of analytic philosophy and took part in introducing the most famous ideas, key concepts which we can recall easily when we are asked to characterise analytic philosophy. Arthur N. Prior could also be listed among these standard bearers for his invention of modern temporal logic and for his zeal for modal logic, which influenced a whole generation of analytic philosophers in the 1950s and 1960s (Copeland 2020 [5]).

However, Prior's own philosophical development was not linked only to key personalities from mainstream analytic philosophy. There are many other sources that have to be taken into account in order to understand his logic and philosophy. Prior began his intellectual career as a theologian and this interest in certain theological issues is preserved in his philosophy, even throughout his agnostic period (see e.g. Prior 2003a [30]). He was interested in and affected by the works of ancient philosophers and Schoolmen, i.e. Diodoros Chronos and John Buridan (see Uckelman 2012 [43]). Thanks to his teacher, John N. Findley, Prior was also acquainted with the Brentanian tradition. Finally, he appreciated the work of members of the Lvov-Warsaw School and adopted their ideas (see Copeland 2020 [5]).

Several of these influences are uncommon and deserve a closer look. Due to Prior's interest in these influences and the impact of his work, certain ideas from them became mainstream analytic philosophy. This paper focuses primarily on the last influence mentioned, i.e. that of the Lvov-Warsaw School, especially the work of one of its lesser-known members, Stanisław Leśniewski, whose ideas Prior adopted in his temporal logic. Prior (1957a, 62–83 [19]; 1967, 162–167 [24]) introduced systems of temporal logic based on Leśniewski's calculus on names called 'Ontology'. These systems were appealing to Prior primarily from the ontological point of view.

Prior's choice is rather surprising with respect to the fact that Leśniewski's system of logic is by no means a standard system and Leśniewski's works were almost inaccessible at the time when Prior established his systems of logic (see Lejewski 1956 [11]). However, Prior's appreciation of Leśniewski's work vanished to some extent with time. In Prior's later work, Leśniewski's system is mentioned sparsely and

usually with some critical remarks (see, e.g., Prior 1969, 35–37 [26]; Prior 1971, 166–167 [27]). The aim of my paper is to describe why Prior adopted certain features of Leśniewski's concept of names and, consequently, why he abandoned this concept towards the end of his life.

## 2 Leśniewski's System of Logic and his Concept of Names

Leśniewski's system of logic and his concept of names are by no means well known even in analytic philosophy. Therefore, it seems appropriate to briefly present it in this section. Leśniewski developed his system as an alternative to the system of logic that Bertrand Russell and Alfred North Whitehead introduced in *Principia Mathematica* since he (1992c, 181–226 [15]) was critical of this system. His main objection concerned set theory as a basis for mathematics. Due to his nominalism, Leśniewski did not agree with the postulation of sets and classes as abstract entities. According to Leśniewski, sets and classes are collections of the entities they consist of. He called such classes 'collective classes' and introduced a new theory dealing with them - Mereology (see Leśniewski 1992c, 197–226 [15]).

Mereology is sometimes described as a nominalistic set theory (see Urbaniak 2014, 111–113 [44]). The system is based on two logical systems – Protothetic, which is Leśniewski's calculus of propositions, and Ontology, which is his calculus of names. Protothetic provides the basic rules of the system, while Ontology, despite rules, introduced also functors and name variables that are later used in Mereology (see Lejewski 1984, 145–146 [12]).<sup>2</sup>

Leśniewski introduced quantifiers in both of his logical systems, Protothetic and Ontology. In contrast to the Russellian concept of quantification, the Leśniewskian quantification does not imply ontological commitment. In some cases, the formulae could be true, even though the values of its bound variables are empty terms. As Simons (2020 [39]) pointed out, Leśniewski's quantification is not referential. Despite Quine's (1969, 104–107 [35]) claim, it is also not substitutional. Leśniewski, however, did not offer a precise interpretation of it.

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<sup>2</sup> In my paper, I wrote Leśniewski's system with capital letters to differentiate between Ontology, which is Leśniewski's calculus of names, and ontology, which is a part of philosophy.

Therefore, its understanding is still under discussion (see Urbaniak 2014, 192–209 [44]).

Leśniewski was aware that he did not have an adequate theory of quantification (see Simons 2020 [39]); consequently, he originally used only a universal quantifier. The existential quantifier was introduced to Leśniewski's system by his students as a simplification after Leśniewski's death. Prior was informed of the fact by both Sobociński (1953 [41]) and Lejewski (1955 [10]). He was primarily influenced by an interpretation of Leśniewskian quantification that Lejewski (1954 [9]) offered in his 'Logic and Existence'.<sup>3</sup> Lejewski (1954, 113–114 [9]) presented in this paper an interpretation in which the quantifier  $\exists$  is not called an 'existential quantifier' but a 'particular quantifier' and is not translated as 'there is...' but 'for some...'.<sup>4</sup>

The fact that empty terms could be values of bound variables is not the only difference in Leśniewski's concept of names. Leśniewski's concept lacks differentiation between proper names, definite descriptions, and indefinite descriptions, all those cases belong to semantical category of names.<sup>4</sup> Consequently, the name variables in Leśniewski's Ontology could stand for one individual, more than one individual and no individual at all (see Prior 1965, 149 [23]).

The name variables are bound by the functor  $\varepsilon$ , which is the primitive functor of Ontology, i.e. all other functors are defined with its help. The interpretation of this functor is also complicated, as Leśniewski (1992c, 375 [15]) described it as *jest*, which is the verb 'be' in Polish. Due to the previously mentioned lack of articles before nouns, the interpretation differs from 'is' in English (see e.g. Ślupecki 1984, 66 [40]).

As was already mentioned, the variables that are bound by this functor could stand for an individual, more than one individual, or even

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<sup>3</sup> In my paper, I differentiate between 'Leśniewski's' (i.e. introduced by Leśniewski himself) and a 'Leśniewskian' (i.e. introduced in the tradition of Leśniewski's system of logic). Therefore, I entitled the concept of quantification that Lejewski presented in his paper 'Leśniewskian'. I have similarly differentiated between 'Russell's' and a 'Russellian'. For example, Prior discussed Quine's ideas that originated in the Russellian tradition several times, but Russell could have not agreed with several of them.

<sup>4</sup> Leśniewski might have chosen this concept because it is closer to Polish, which also lacks this differentiation due to the absence of articles before nouns. He wrote, however, also in languages which require articles before nouns (especially German). Therefore, the most probable explanation of this feature of Leśniewski's concept of names is the one that appeared in Ajdukiewicz's (1978, 96–97 [1]) paper. Namely, this way of dealing with names is less detailed than the one proposed by Russell.

no individual at all (even though in the last case the resulting formula would be well-formed but always false (see Śtupecki 1984, 66 [39]). The best description of this functor is that it forms a proposition from two names (in a Leśniewskian sense of the word 'name') (see Prior 1976, 117 [28]).

### **3 Prior's Adoption of Leśniewski's Concept of Names**

Prior discussed Leśniewski's work even before introducing his temporal logic and the systems that were influenced by Leśniewski's Ontology. He presented his view on Leśniewski's theories of definitions, quantifications and names already in 1955 in papers 'English and Ontology' and 'Definitions, Rules and Axioms' and chapter on Leśniewski's system of logic appeared also in his book *Formal Logic* (see Prior 1955b [17]; 1955-1956 [18]; 1963, 293–300 [22]).

Prior's interest in Leśniewski could be due to his previous acquaintance with work of his colleague Jan Łukasiewicz. However, two of Leśniewski's students, Czesław Lejewski and Bolesław Sobociński, introduced Prior to Leśniewski's work, as their letters to Prior prove (see Rybaříková 2016, 244–245 [36]). Prior (1957a, 63 [19]) also knew and quoted their papers on Leśniewski. As Lejewski (1956 [11]) reported, Leśniewski's papers were not easily accessible at that time. Prior, therefore, had to rely primarily on secondary literature, when he investigated Leśniewski's theory.

Another reason for Prior's interest in Leśniewski's work might be his philosophical position. When working on his temporal logic, Prior held several views that are difficult to combine. Firstly, he was a proponent of presentism, i.e., the view that neither the past nor the future is real (see Jakobsen 2011 [7]). Second, Prior (1968, 94 [25]) claimed to be a nominalist. In his understanding of the word, this meant that he denied the existence of abstract entities. In their book on Prior's ontology, Hugly and Sayward (1996, 34–54 [6]) doubted whether Prior was really nominalist and proposed arguments against this view. However, as Simons (1998, 1–3 [38]) pointed out, there are several understandings of the term 'nominalism'. Therefore, it could be the case that Prior held a different kind of nominalism than the one defined by Hugly and Sayward.

Third, Prior was convinced that propositions could change their truth-value in time, and therefore he was a proponent of temporalism (see Prior 2003e, 195–196 [34]). Finally, as a founding father of modern temporal logic, Prior had to adjust these views with temporal logic and temporal ontology. Prior (1957a, 62–63 [19]) argued that answers to certain issues could be found in Leśniewski's work, namely Leśniewski's theory of quantification and his concept of names.

### 3.1 The System Q

When Prior (1955a [16]) introduced temporal logic, he presented it as the logic of propositions. Nonetheless, he was aware that certain philosophical problems require formalisation in predicate calculus. The most problematic issue was the question of how to deal with individuals whose existence has a beginning and an end. To handle these individuals, Prior introduced a system of many-valued logic Q in his *Time and Modality*. Originally, Prior (1957a, 41–46 [19]) postulated this system as a calculus of propositions, but he also presented three alternative systems of predicate logic derived from it.  $\Sigma T1$ , is the system Q combined with a Russellian predicate calculus, and  $\Sigma T2$  and  $\Sigma T3$  that are the system Q combined with Leśniewski's Ontology.

The difference between the second and the third calculi consists in the specification of the article 'the' that precedes names in these systems. In the system  $\Sigma T2$ , the article 'the' appears as the weak 'the'. The definite article is weak if it could refer to various individuals in time, as in the subject of the proposition 'The Queen of England is in Balmoral'. The referent at each time has to be, however, one at most. The propositions that contain the weak 'the' in the subject could be true only if the subject refers to precisely one individual. On the contrary, the article 'the' is characterized as the strong 'the' in the system  $\Sigma T3$ , i.e., the name bound by this article refers to the same individual regardless of time, for example in the subject of the proposition 'The first president of the Czech Republic was the dramatist' (see Prior 1957a, 63, 76 [19]).

Prior (2003d, 114 [33]) was aware that temporal predicate calculi contain several ontological issues. Especially problematic is the ontological specification of individuals which have ceased to exist or have not begun to exist yet. There are propositions that address those individuals, for example, 'Joan of Arc was a great warrior'. The subjects of such propositions have no reference at the moment. Prior did not

intend to admit the existence of possibilia, possible world or time instants. Therefore, the reference of variables which stand for such kind of individuals is troublesome, particularly if it is taken in accordance with the Russellian account of individuals, existence, and quantification. These troubles might have led to Prior's inclination towards Leśniewski's Ontology.

### 3.2 Quantification

Quantification in a modal context was a highly discussed topic when Prior introduced his system Q (see Copeland 2006, 373, 390–392 [4]). The issue that Prior (1957a, 27 [19]) stressed concerns the Barcan formula, which is a theorem of the quantified system of modal logic S5:

$$\Diamond \exists x \varphi(x) \rightarrow \exists x \Diamond \varphi(x)$$

The standard understanding of the formula at that time was to interpret it referentially, even though Barcan Marcus preferred substitutional interpretation (see Copeland 1982, 83 [3]). In the referential interpretation, the formula means that if it is possible that someone exists who  $\varphi$ , then there exists someone who will possibly  $\varphi$ . For instance, if it is possible that there exists someone who builds the first fusion power plant, there exists (now) someone who possibly builds the first fusion power plant. The issue is even more apparent (and less obscure) when it appears in Prior's (1957a, 29 [19]) temporal logic:

$$F \exists x \varphi(x) \rightarrow \exists x F \varphi(x)$$

This is to say that if it will be the case that someone exists who builds the first fusion power plant, there exists someone about whom it will be the case that they build the first fusion power plant. Although the original formula concerns modal systems of logic, Prior linked his systems of temporal logic closely to modal logic. He (1957a, 29 [19]) pointed out that while the consequent of the Barcan formula implies that someone who will possibly one day build the first fusion power plant somehow exists at present, the antecedent does not have such an implication. Consequently, if the individual which concerns the proposition in future tense does not exist, the antecedent of the Barcan formula is true, but its consequent is false, hence the whole formula is also false.

The solution to this problem could be the postulation of the eternal existence of all individuals. Something that Prior (1957a, 30–32 [19]) called ‘a permanent pool of objects’. In this case, the one that possibly builds the first fusion power plant is somehow existent, even if he or she is not born yet. However, Prior was not willing to postulate such a pool with individuals as it would contradict both his nominalism and presentism. Therefore, one possible solution is to abandon the Barcan formula. Prior (1957a, 27, 32–34 [19]) pointed out, however, that in this case the implementation of the system of modal logic S5 into temporal logic also has to be dropped. According to Prior’s (1957a, 62–65 [19]), there is another solution to this problem, namely, leaving Russell’s concept of names and quantification and adopting Leśniewski’s theory.

Prior (1955b, 65 [17]) was convinced that the interpretation of the quantifier  $\exists$  as a particular quantifier ‘for some...’, as Lejewski (1954, 113–114 [9]) proposed, does not imply ontological commitment. In the Leśniewskian quantification, the variables in the true quantified formulae do not have to stand for the existent entities. As Prior (1957a, 65 [19]) argued: ‘For in this system to be a value of a variable is not the same thing as to be’. Consequently, a system which contains the Leśniewskian quantification and his concept of names could contain the Barcan formula without implying its unwelcomed consequences.

### 3.3 Leśniewskian Names

Adopting Leśniewskian quantification, Prior (1957a, 63 [19]) also included other features of Leśniewskian calculus of names in his alternative system of temporal logic, namely the Leśniewskian concept of names and the functor  $\varepsilon$ . This alternative system of temporal logic was not based on predicate calculus but on Leśniewski’s Ontology, the previously mentioned systems  $\Sigma T2$  a  $\Sigma T3$ . However, those systems are Leśniewskian systems, but not Leśniewski’s, as Prior excluded Leśniewski’s axiom of extensionality from them (see Prior 1957a, 69–71 [19]). If this law is applied to the intentional system of temporal logic that Prior constructed, it would lead to paradoxes.

Prior (1967, 162 [24]) described Leśniewskian names as ‘devices that refer to individuals obliquely’. He (1957a, 63–64 [19]) claimed that they



should be interpreted as common nouns.<sup>5</sup> According to Prior, common nouns could refer to just one individual, more individuals or no individual at all, as is required for Leśniewskian names. Similarly, variables occurring in this system are not noun-variables but rather common-noun-variables. The functor  $\varepsilon$ , despite being described by Leśniewski as *jest*, is not primarily verb, but the functor which forms a proposition from two common nouns, according to Prior (1976, 117 [28]).

Prior (1957a, 65 [19]) was convinced that this concept of names prevents the postulation of sempiternal entities (or necessary entities in a modal interpretation). The advantage of this concept of names is also its drawback, according to Prior (1957a, 66 [19]). Namely, it is more difficult to distinguish between cases when it is not known if the entities exist and between those for which we have such knowledge. These characteristics of entities are expressed by functors *ob* and *ex* in Leśniewski's system.  $\exists a ob(a)$  means 'some *a* is an object', while  $\exists a ex(a)$  means 'some *a* exists'.

Another important feature of Leśniewskian names is that they are logically complex. This means that one name could be constructed out of two other names, for example, empty term as '*a* and non-*a*'. Such an empty term belongs also to the semantical category of names in Leśniewski's Ontology. In Russellian theory, the term 'names' means proper names and cannot be complex (see Prior 1965, 150 [23]).

This feature was important for Prior's dealing with individuals in time. Namely, Prior introduced the paradox of identity in time:

Suppose people reproduced like amoebae, and suppose you and I are the two products of such a fission, each of us having a perfect memory of having been the one original person, though now the two of us are both being and doing quite different things, say me reading Plato and you not. [...] I can say, for example, 'I remember those sardines I ate before you were born,' and you can say this to me too, both of us referring to the same occurrence and both referring to it equally correctly. And equally – just a little bit – incorrectly; for if both were quite correct I could say, for us both, 'I remember those sardines I ate before you were born, and you remember those sardines you ate before I was born;' but I cannot

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<sup>5</sup> Later, Prior (1965 [23]) also interpreted the Leśniewskian concept of names as class names. This interpretation is rather controversial, even though reasons could be found for its introduction, as I have discussed elsewhere (see Rybaříková 2019 [37]). Nevertheless, even in this case Prior was convinced that Leśniewskian names are common nouns from the ontological point of view.

say this, for I cannot admit that I was not in existence when the sardines were eaten.

(Prior 1957b, 196 [20])

However, this thought experiment is quite artificial. Prior (2003c, 96 [32]) later provided a more natural version, in which a fission takes place in a unicellular organism, e.g., where there used to be one amoeba, there are now two amoebae.<sup>6</sup> Regardless of the example, the point in a scenario like this lies in the fact that there are two individuals where there used to be just one. And this point is challenging for formal logic and primarily to Leibniz's law of the indiscernibility of identicals:

$$(x = y) \rightarrow (\varphi(x) \rightarrow \varphi(y))$$

That is, in this scenario Leibniz's law of the indiscernibility of identicals does not hold.

Prior (2003c, 100–101 [32]) pointed out that this scenario could be formalised if individuals that interact in time are replaced by four-dimensional objects that appear in space and time, and that would be branching in the time of the fission. Simons (2020 [39]) argues that the concept of a temporally extended object was discussed by Leśniewski (1992c, 380–382 [15]), when he considered the meaning of the functor  $\varepsilon$  in the proposition 'Warsaw of 1830 is smaller than Warsaw of 1930'. Leśniewski described Warsaw as a four-dimensional object developing in time and space since its beginning to the end of its existence. This object could be divided into several time slices, e.g. 'Warsaw of 1830' and 'Warsaw of 1930'.

Alternatively, it could be the case that the earlier temporal parts of an object in Prior's scenario are at just one place in space, while the later temporal parts of it are divided in space. Lejewski developed a system focused on such issues: 'chronology'. It was based on Leśniewski's

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<sup>6</sup> The disadvantage of unicellular organisms consists in the fact that they do not have a memory in our sense of the word. Therefore, Prior's example of recalling a sardine feast could not be applied to them. On the contrary, cities and towns could be quite natural examples of both fission and fusion if we consider cities and towns as individuals. Large cities tend to swallow smaller towns and villages in their neighbourhood as they grow. There are also examples of fission, either if one previously swallowed town decides that it wants to be independent again or if a city is divided, for instance, by borders.

Mereology (see Prior 2003c, 100 [32]). In summary, another idea from Leśniewski was inspirational to Prior's temporal ontology.

However, this solution contains two drawbacks. First, Mereology includes the thesis that 'for any pair of objects there is a third object that which simply consists of the two of them together' (see Prior 2003c, 100 [32]). This means that two individuals who appeared after a fission would remain connected even after their fission. Second, Lejewski's chronology corresponds better to eternalism than to presentism, since the individuals are described as four-dimensional continuants that persist in time (see Prior 2003c, 100–101 [32]). This understanding of time is strongly included in Leśniewski's system of logic and, as will be discussed in the following section, could have led to Prior's eventual abandonment of Leśniewski's theory.

## 4 Leaving Leśniewski

It was already mentioned that Leśniewski's concept of names was mainly introduced as a part of Prior's system Q. This interpretation appeared in *Time and Modality* and was also discussed in Prior's *Past, Present and Future*. However, it did not appear in Prior's latest books, *Papers on Time and Tense* and *World, Times and Selves*, even though the system Q is still developed in them (see e.g. Prior 2003d, 115–116 [33]; 2003e, 270–273 [34]). In his book *Objects of Thought*, which does not concern temporal logic, but mainly the epistemic system of logic, Prior (1971, 166–167 [27]) was even critical of Leśniewski's system of logic and his concept of names. There are several possible reasons why this was the case, as will be presented in this section, namely the fact that Leśniewski and Prior's philosophies differ considerably, that new concepts of names were postulated in those years, and finally that Prior began to explicitly prioritize intentionality and consequently became critical to Leśniewski's extensionality.

### 4.1 The Differences between Leśniewski and Prior's Philosophy

The first reason why Prior abandoned Leśniewski's concept of names could be that certain parts of Leśniewski's philosophy are in clear

contrast to Prior's views, primarily Leśniewski's eternalism and determinism. Both views appeared already in Leśniewski's early papers 'The Critique of the Logical Principle of the Excluded Middle' and 'Is All Truth Only True Eternally or It Is Also True Without a Beginning?' (1992a, 83–85 [13]; 1992b, 97–98, 102–103 [14]). Leśniewski later recanted on his early work (see Betti 2006, 66 [2]). However, his views on time and truth seemed to have penetrated even his late works, as his discussion on the meaning of the functor  $\varepsilon$  proves (see Leśniewski 1992c, 377–378 [15]).

It was already mentioned that Prior was a proponent of temporalism, i.e. the view that propositions could change their truth value. In his early papers, Leśniewski argued the contrary. As the title of the second paper shows, he (1992b, 98–103 [14]) claimed that if the proposition is true, it is true sempiternally, i.e., from the beginning of the universe to its end. This may sound strange in the case of propositions such as 'Stanisław Leśniewski is dead' as this proposition was not true before Leśniewski's death but it is true now.

According to Leśniewski, any single use of this proposition is a different proposition, due to indexicals.<sup>7</sup> Thus, the true proposition 'Today, it is Thursday' written by me today, is not the same as the false proposition 'Today, it is Thursday' that I could perplexedly say tomorrow or any other day of the week. It is also a different proposition from the one I could truly express next Thursday.

Furthermore, Leśniewski (1992c, 377–378 [15]) consciously excluded time from his system of logic. He argued that the functor  $\varepsilon$  does not include temporal interpretation in the sense 'is now'. Prior (1957a, 69 [19]) was aware of this fact. In *Time and Modality*, he pointed out that Leśniewski approach to tense in logic resembles other opponents of temporal logic, such as Quine and Smart.

Additionally, Prior was an eager advocate of indeterminism and the beginning of his temporal system of logic is linked with its defence (see Prior 1955a [16]). On the contrary to Prior, Leśniewski (1992b, 102–103 [14]) in his paper 'Is All Truth Only True Eternally or It Is Also True Without a Beginning?' vindicated determinism. Leśniewski (1992b, 103 [14]) claimed that all true propositions were true sempiternally. Thus, the proposition 'Caesar crosses the Rubicon in 49 BC' was true even before Caesar made such a decision. All the future contingent propositions have

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<sup>7</sup> Leśniewski vindicated eternalism that is common in current analytic philosophy due to Frege's influence. However, this concept of propositions was not as prevalent as it is presently at the time Leśniewski formulated his views.

certain truth-value as well. But this does not mean, according to Leśniewski (1992b, 112–113 [14]), that we do not have free will. In contrast, he maintained that the combination of a determined universe and free will is possible. Consequently, Leśniewski was a proponent of compatibilism, but the precise description of his solution would exceed the scope of my paper.

Leśniewski targeted this discussion to his colleague Kotarbiński, who previously published the paper ‘Zagadnienie istnienia przyszłości’ [The Problem of the Existence of the Future]. Kotarbiński (1913 [8]) argued in this paper that future contingent propositions could not obtain one of the traditional truth-values true or false, as it could negatively affect human free will and also creativity. Kotarbiński (1913, 79, 86–88 [8]) maintained that these propositions are neither true nor false but indefinite. Due to this proposal, Kotarbiński is considered as a precursor of Łukasiewicz’s many-valued systems of logic, even though Leśniewski’s argument forced him to abandon his own views (see Woleński 1990, 194 [45]).

Unlike Leśniewski’s eternalism, there is no evidence that Prior was familiar with this discussion, when he proposed the adoption of certain features of Leśniewski’s Ontology in his *Time and Modality*. However, Prior visited Warsaw in 1961. In one of his letters to his wife Mary, who was also a philosopher, he recalled a discussion on this topic with Kotarbiński:

I was sitting at a tea-table discussing determinism with Kotarbiński, in French. Apparently in 1913 he wrote an article about the difference between the past and the future, developing an indeterminist position, with even a hint of a 3-valued logic, but not formalised; but Lesniewski convinced him that his position was inconsistent, and he has been a determinist ever since.

(Prior 1961, 1 [21])

Therefore, Prior discovered the discrepancy between his and Leśniewski’s approach to determinism at the latest in 1961.

## 4.2 Alternative Concepts of Names

Although Prior (1971, 167 [27]) argued that Russell’s and Leśniewski’s concepts on names are the most elaborate at that time, he also pointed out that there are also other concepts. These concepts might be another

reason why he abandoned Leśniewski's concept of names. In his *Time and Modality*, he only discussed Russell's, Leśniewski's, and Frege's approach.<sup>8</sup>

Prior introduced several other concepts in his *Past, Present and Future*, however. Namely, he presented the concepts of names and theories of quantification in the temporal ontology of Nino Cocchiarella, Nicholas Rescher, Charles Hamblin, Dana Scott, and Saul Kripke (see Prior 1967, 158–162 [24]). Furthermore, Prior (1967, 167–169 [24]) considered G. E. Hughes and D. G. Londey's logic of 'empty universes' and their theory of quantification. The majority of alternative concepts of names formulated by Prior's contemporaries came from Russellian tradition. Prior (1967, 169–174 [24]) also developed his own concept of names, which was closely related to the systems of temporal logic in this book.

Prior's concepts developed further, as his discussions in *Papers on Time and Tense* and *World, Times, and Selves* prove. His inspiration was not just Russell and Leśniewski's ideas, but he also included ideas from other 20<sup>th</sup> century philosophers (see e.g. Prior 2003c, 93 [32]) and certain Schoolmen (see e.g. Prior 2003b, 86 [31]). Unlike the Schoolmen or Prior's contemporaries, neither Russell nor Leśniewski sufficiently took modality or temporality into account. Furthermore, Leśniewski's Ontology is not based on English, and grasping articles is more complicated, as Prior (1957a, 64–65 [19]) mentioned in *Time and Modality*. Thus, he might prioritize later those concepts that lack this clumsiness.

Prior (1971, 155–170 [27]) addressed this issue once again in his book *Objects of Thought*, even though this book does not concern temporal logic. The main topic, as the title suggests, is entities which we think of and those that we think about (see Prior 1971, 3 [27]). Therefore, Prior's concept of names and a discussion that is related to it did not consider temporal but epistemological aspects. When Prior (1971, 167–170 [27]) presented concepts of names that are alternatives to those proposed by Russell and Leśniewski, he also mentioned the work of Hintikka, Kanger, and Kripke, who developed their concepts in modal logic.

### 4.3 Extensionality

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<sup>8</sup> Prior did not develop a system of temporal logic based on Frege's ideas in *Time and Modality*. Therefore, I did not discuss his approach to names and propositions in my paper.

In his latest period, Prior (1968, 91–93 [25]) opted explicitly for intensionality. Namely, he claimed that there are intensional functions but not intensional objects or intensions, i.e. he included intensional functions in his systems of temporal and modal logic, but he excluded possible worlds, time instants, or possibilia. The latter would have violated nominalism. He aimed to formalized also, e.g., epistemic contexts, and pointed out that extensional logic is not suitable for this (see Prior 1968, 92 [25]). Consequently, Leśniewski's system was not suited for his purpose. Prior (1957a, 67–69 [19]) noticed already in his *Time and Modality* that Leśniewski system is not appropriate for intentional context, but he discussed the issue in more detail throughout *Objects of Thought* (see Prior 1971, 166–167 [27]).

Extensionality is, however, deeply rooted in Leśniewski's system of logic. Prior knew about this and pointed it out as in his paper 'Existence in Lesniewski and in Russell':

Leśniewski's own system is, indeed, characterized by an extreme extensionalism which is not likely to appeal very much to the philosophers I have in mind, and for that matter it doesn't appeal to me either; this extensionalism, moreover, is thoroughly wrought into Leśniewski's methodology — underlying, for example, his rule of definition — as the use of individual names is wrought into Russell's theory of classes.

(Prior 1965, 154–155 [23])

Prior was convinced at that time that this obstacle could be overcome:

However, I am sure that with a little trouble one can disentangle the more desirable features of ontology from this less desirable one, just as ontology itself disentangles the pure theory of common nouns from its Russellian name-and-predicate basis.

(Prior 1965, 155 [23])

He abandoned this conviction later, however.

Prior was right that extensionality is essential for Leśniewski's system of logic. In fact, extensionality was crucial for nearly all systems of logic which the logicians from the Lvov-Warsaw School postulated. Surma (2012, 146–148 [42]) claim that this prevalent conviction might have originated in Leśniewski's views. Leśniewski's denial of intensionality was caused by his anti-psychologism. He identified an intensional

context with psychology and therefore considered intensional systems of logic corrupted by psychologism. Additionally, as Russell and Whitehead based their foundation of mathematics on an extensional system of logic, intensional systems might have seemed superfluous to Leśniewski.

When dealing with temporal systems of logic, Prior had a different objective than the foundation of mathematics, as he acknowledged in his paper 'A Statement of Temporal Realism':

..., but the greatest gain that a logic of tenses brings is the accurate philosophical description of the reality of the passage of time.

(Prior 1996, 46 [29])

Prior used his systems of temporal logic to formalise philosophical issues, mainly those linked with determinism. Formalising these queries, Prior focused on the formalisation of natural language. To do it more precisely, he also needed an intensional context, since he maintained that extensional context alone is insufficient to grasp all the subtleties of natural language (see Prior 1971, 48–49 [27]).

## 5 Conclusion

Prior was one of the first non-Polish philosophers who appreciated a certain number of Leśniewski's ideas and adopted some of these ideas into his systems of logic and ontology. While at the beginning of the postulation of temporal logic, Leśniewski's concept of names played a significant role in his temporal ontology, it seems that Leśniewski's influence vanished with time. There may be several reasons for this step; as I presented in my paper: how gradually and deeply his philosophical views differ from Leśniewski's, and new concepts of names appeared apart from Russellian and Leśniewskian names, but the most plausible seems to be the extensionality of Leśniewski's system.

In contrast, even where Prior is quite critical to Leśniewski's extensionalism in his book *Objects of Thought*, Prior was still a proponent of a non-nominal quantification. In fact, non-nominal quantification played a crucial role in Prior's combination of nominalism and intensionality (see Prior 1971, 31–47 [27]). Unfortunately, there are just a few hints that the non-nominal quantification which Prior used is still the



one Leśniewski's presented; however, Prior did not directly address Leśniewskian quantification. Prior's (1971, 46 [27]) descriptions of quantification in which he spoke about syntactical categories and the functors that bind them support this reading quite convincingly.

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