A LOGICAL-PRAGMATIC THEORY OF OBJECTS

Augustin RIŠKA

There are two fundamental questions concerning the choice and presence of objects in various formal systems: (1) Where do these objects come from? (2) What do (can) we know about them? To answer these questions I introduce the notion of a proto-ontology as the pre-theoretic realm of (unspecified) entities from which the basic objects – individuals – of the formal system S are postulated. The pragmatic aspects of such choices are investigated with regard to first-order logic, both pure and applied, set theory and mereology. It is claimed that the postulated (chosen, constructed) objects enter the formal system S with a package of properties and relationships, the recognition of which depends on the interpretation and application of the available predicates of S. If these properties and relationships are not made explicit, a possible clash may arise between them and the properties and relationships "assigned" to the individuals of S by the interpreted predicates of S. As regards the relationship between logic and metaphysics, I contend that logic can perhaps be viewed as the articulation of the fundamental features of proto-ontological objects without which no discourse or theory would be possible. In this sense logic could also be viewed as a theory and method of the construction of a well-articulated metaphysical theory.

Theory of objects represents one of the meeting points between logic and metaphysics. Although a logical theory is concerned with the legitimate principles of our discourse about objects, and not with the objects themselves, sooner or later ontological issues will be enforced upon it, as witnessed, e.g., by Quine's preoccupation with the so-called *ontic commitment*.[1] This leads to questions of concrete objects (e.g., physical objects) and abstract objects, such as classes, attributes, propositions, numbers, relations and functions,[2] just as to the discussion of the traditional issues of particulars and universals (via the distinction between singular and general terms). In the present essay, instead of dwelling on these familiar problems, I shall focus on the *pragmatic* aspects of the choice of objects in various formal systems, especially in elementary logical theories. This task leads us to the introduction of the so-called *proto-ontology* that represents the realm of objects from which we select the objects of formal systems.

[1] See Quine (1960), (1961), also R. H. Severens (1974), and many other works.

[2] Quine (1960), 233; a very extensive literature is devoted to these issues.

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I. Objects in formal systems

The postulation of objects (individuals) as members of the universe of discourse U relative to a formal system S poses many metaphysical and epistemological questions, such as: (Q1) Where do these objects come from?, (Q2) What do (can) we know about them? Usually these questions remain unnoticed at the stage of giving a semantic interpretation to the expressions of S, formed or transformed on the basis of the legitimate syntactic rules of S. It seems that a working logician or mathematician fears the burden of such questions, as if they had a paralyzing effect on further development of the particular logical or mathematical system and perhaps even more on its applicability. Nevertheless, these questions are seriously considered in the foundational studies and different answers have produced diverse positions in the philosophy of logic and mathematics: a) Platonist realism, b) intuitionism, c) formalism.[3] On the Platonist view, the individuals – the values of individual variables – exist independently of selecting them as members of U; from these objective resources we can posit the individual objects (say, *a*, *b*, etc.) as discernible entities. A typical intuitionist view, on the other hand, regards these objects as mental constructs produced beforehand or in the course of postulation. As the classics of the intuitionistic school used to express the difference, while the Platonists think that they are discovering (finding) objects, the intuitionists, like artists, are creating them. Finally, a formalist has a tendency to treat objects as linguistic symbols (e.g., numbers as numerals), regarded as types or perhaps only as tokens. Although the minimal condition imposed upon the choice of U (i.e., that U have at least one member) is acknowledged in all these positions, the maximal condition, establishing the cardinality of U, is not shared. It is known that a Platonist has a tendency to accept actual infinities, including the entire Cantorian paradise, so that the object resources would be rich beyond any limitation. On the other hand, a typical intuitionist constructivist shuns actual infinities and Cantorian paradises and settles for the denumerable infinity, reached potentially. In addition, a radical formalist may go even further and reject any infinite collections, operating thus

[3] Here I refer to the standard literature on these subjects, viz. to the works of Heyting, Brouwer, Dummett, etc. (intuitionism and neointuitionism), Hilbert, Curry, etc. (formalism), Whitehead, Godel, etc. (Platonism) See also the anthology edited by P. Benacerraf and H. Putnam (1964) and the magnificent source book edited by J Van Heijenoort (1967)

only with a finite number of objects (linguistic symbols). Of course, this finitist position makes the logic of quantifiers (predicate logic) reducible to the truth-functional logic, for – as Wittgenstein already suggested in his *Tractatus* – universal quantification could then be treated via conjunction and existential quantification via disjunction. To avoid this trivial situation, logicians of various persuasions agree in accepting denumerably infinite domains of objects, equivalent to the set of natural numbers, in both the syntactic and the semantic levels of building a formal system (otherwise we could not operate, for instance, with an infinite supply of individual variables).

II. Pragmatic aspects of the choice of individuals

The postulation of the individuals as members of U, tacitly assumed on the semantic level, can and should be explicitly treated on the pragmatic level. We do talk about the choice or selection of the individuals and, undoubtedly, choice is a pragmatic operation requiring a person who makes the choice and something to be chosen from. Hence the previous questions, dealt with in the foundations of logic and mathematics in general, can be translated into the language of *formal pragmatics*.[4] Among the predicates of this language (which is a metalanguage as to the language of S) we introduce the predicate C ("choosing") so that C(X, *a*, O) will read "Person X chooses the object *a* from the domain of objects O." What is then the domain O in the case of building up the universe of discourse U? We have to assume here the existence of a *proto-ontology* containing the objects from which one can choose. Obviously, if such proto-ontology is empty, there are no objects to choose from and the predicate C is inapplicable, unless one reinterprets it as "construing" (but then 'O' must also be replaced by something else, e.g. 'M', meaning "mental resources" or something like it). It is to be noted that proto-ontology is not the same as the so-called *formal ontology* of a system S. While formal ontology is an "internal" affair of the system S, made explicit in the process of semantic interpretation, a proto-ontology provides the resources needed for the constitution of a formal ontology. Evidently, formal ontology is always relativized to the system S in question. Can we say the same about proto-ontology? To put it differently, are there objects in an

[4] Formal pragmatics has been developed due to the work of Ch. Morris, R. Carnap, R. M. Martin, R. Montague, and others. See e.g. R. M. Martin (1959).

"absolute" sense, preceding and independent of any system S? Even if one may entertain such an idea in general metaphysics, our pragmatic approach forces us to consider proto-ontologies only in relation to a particular system S. From the logical standpoint, the best initial candidate for a scrutiny is the *pure* predicate logic of first order (PL_1-pure). Afterwards we shall move to the *applied* predicate logics of first order (PL_1-appl.) and to other logical systems.[5] Once PL_1-appl. appear on the scene, arithmetical theories and set theories will have to be considered as well, functioning as close relatives.

III. Proto-ontology of PL1-pure

As known, PL_1-pure has in its syntactic repertoire only individual variables and predicate variables and quantification is permitted only over the individual variables (obviously, the repertoire of truth-functional logic is presupposed too). What is now the domain O from which the individuals *a*, the members of U, are being chosen? Apparently, the domain O is pragmatically related to the person X, assuming, in addition, that the person X knows that he/she is postulating the universe of discourse for PL_1-pure. The situation can be expressed as follows:

(1) $C(X, a, O) \rightarrow D(X, a/U, PL_1\text{-pure})$.

This means: "After choosing an object *a* from the domain O, X postulates this object in the universe U of (for) PL_1-pure." The pragmatic predicate D is thus interpreted as "postulating" or "positing". The arrow represents the transition from one pragmatic operation to another. Of course, as in the case of a simultaneous multiple substitution, objects *a* may be selected by X *en bloc*, either exhausting the entire domain O, or utilizing a subdomain of O. Naturally, the above formula puts too strict constructivist constrains on the selection of the individuals, should X actually take each chosen *a* from O and place it into U. Effective rules or criteria for such choice and postulation are indeed sufficient tools, replacing the need of actually performing such operations (obviously, considering also the time factor involved). The application of our formula (1) to the above mentioned three foundational positions results in the following.

[5] A very good distinction between pure and applied logical systems is offered in the classical textbook by A. Church (1956).

Platonism. O exists (subsists) independently of X and PL_1-pure, hence *a*'s are being *imported* from O into U of PL_1-pure. At the same time, O (and thus U as well) may be subjected to a Cantorian set theoretic treatment.

Intuitionism. First the objects *a* are mentally construed by X (actually, one by one, or by means of an effective rule, assuming a finite number of steps), then they are postulated as individuals of U. The restrictions of effective constructions will of course put limitations on O and U as well.

Formalism. O consists of linguistic objects as conventionally chosen symbols (human artifacts). X chooses such objects, either one by one or according to an effective rule of generating them, and postulates them as members of U (i.e., in fact, '*a*', '*b*', etc. are members of U, not *a*, *b*, etc.). Nominalistic limitations are quite obvious here, depending on the availability of various linguistic symbols. Notice also that O is here used for both the syntactic and the semantic needs of PL_1-pure.

Let us now proceed to our initial question (Q2): What do (can) we know about the objects *a* from O? First of all, one might say that X's choice of *a*'s as members of U is filtered through the syntactically prepared part of PL_1-pure, and, in addition, by the *intended* semantic interpretation of PL_1-pure. Since in PL_1-pure there are neither predicate constants nor individual constants (proper names), the objects *a* will be treated as unspecified yet discernible entities, perhaps like the infamous bare particulars. As such, all these objects are on an equal footing and chosen at random (their ordering is inessential and strictly conventional, unlike that of natural numbers, for instance). Each of them is equally good candidate for being the value of any available individual variable of PL_1-pure. At the same time, each of these objects must "obey" the legitimate laws (axioms and theorems) and rules of inference of PL_1-pure, although the essential contribution in this respect is that of the quantifiers and sentential connectives.[6]

On the Platonist view, *a*'s imported by X from O to U are stripped of all their specific characteristics, yet these characteristics (properties, relations, etc.) will be returned to them in a controlled way – through the application of specified, interpreted predicates. Traditionally, this

[6] These topics are extensively discussed in the current books on philosophy of logic (Quine, H. Putnam, S Haack, etc.). See also I Hacking (1979), 285 – 319 (discussion between Hacking and C. Peacocke).

amounts to the familiar interplay between particulars and universals, with all the difficulties involved.[7]

Although in the intuitionist position *a*'s are products of X's mental constructions, the high level of abstraction is also stripping them of their specific characteristics, and in the formalistic game the simplicity (or rather "bareness") of these objects is imitated by the simplicity of the corresponding symbols (even indexing, i.e., using a_1, a_2, etc., will not spoil this game).

In all these positions, several important assumptions should be made explicit by translating them into the pragmatic level.

(i) There is at least one *a* in O (an ontological assumption)

(ii) X apprehends this *a*; symbolically: A(X, *a*)
(an epistemological assumption)

(iii) $C(X, a_1) \rightarrow D(X, a_1/U, PL_1\text{-pure})$ (a pragmatic assumption)
Here *choosing* is a two-placed predicate, skipping the reference to the domain O. The chosen individual *a* is baptized as a_1.

(iv) There is at least one *a* in $\{O - a_1\}$ and $a = a_2 \neq a_1$.

(v) X apprehends this *a* (i.e., $A(X, a_2)$)

(vi) $C(X, a_2) \rightarrow D(X, a_2/U, PL_1\text{-pure})$,

Etc., etc.

Of course, the core of this procedure is the standard set theoretic "trick" used in ordering sets. Yet the pragmatic operations are much more complex, enriched by the predicates 'A', 'C' and 'D'. We can also include among the assumptions X's apprehension of the distinctness (non-identity) between a_1 and a_2, and, generally, between any pair of objects a_i and a_j (*i*, *j* ranging over positive integers). This procedure can be extended much further, covering X's apprehension of the properties of *a* and of the relations between *a* and other objects from O. In addition, X's awareness of separating such properties and relations from *a* and reserving for them special linguistic expressions (predicates), might be added to this rich epistemological package. Let us, however, omit these problems and have a look at the similar situation in PL_1-appl.

[7] See, e g., B. Russell (1911)

IV. Proto-ontology of PL1-applied

An applied predicate logic of first order contains also predicate constants and individual constants. The universe of discourse is made out of *specified* objects *a*, for instance, out of natural numbers. A simple adaptation of our formula (1) leads to:

(2) $C(X, a, O) \rightarrow D(X, a/U, PL_1\text{-appl.})$.

Now we have to focus on O: what is the domain of objects from which X chooses the individuals, members of of U? Is this the same O as in the case of PL_1-pure? Or do we get the following situation?

$C(X, a, O) \rightarrow D(X, a/U, N) \rightarrow C(X, a/U, N) \rightarrow D(X, a/U, PL_1\text{-appl.})$?

This would mean that first X chooses an object from the proto-ontology relevant to the arithmetical theory N, then postulates this object as a member of U of N; afterwards he/she chooses the same object from U of N and postulates it as a member of U of PL_1-appl. An interpreted arithmetical theory N plays here the role of a mediator between the "pristine" realm of proto-ontology and our applied PL_1. Of course, the attention is automatically turned toward the foundations of arithmetic. Whatever philosophical position is adopted (whether natural numbers are treated in Kronecker's style, or in Frege-Russell mode as classes of equivalent classes, or given through the standard interpretation of Peano's axiomatics), once they have been postulated or generated within a *bona fide* N, their importation into PL_1-appl. is quite automatic. However, these individuals – natural numbers – enter U of PL_1-appl. with their characteristic properties, "trimmed" by the arithmetical theory in question. Unlike the objects imported from O to U of PL_1-pure, which were stripped of all their properties and relations (resembling thus the old Aristotelian substances), natural numbers are odd or even, greater than 1, and so on. Characteristic properties and relations of natural numbers have already been captured, say, by Peano's axioms or by arithmetical meaning postulates. In other words, natural numbers are imported into PL_1-appl. as individuals defined by an arithmetical theory N, i.e., with an *analytical* package of properties and relations (analytical as to N), which enforces an appropriate interpretation of predicates of PL_1-appl. This fact could be expressed in our pragmatic terminology, showing the consistency or inconsistency of X's operations (depending upon X's recognition or non-recognition of such analytical package).

By analogy, we could extend this line of reasoning to any choice of individuals for PL_1-appl., e.g., for real numbers, Euclidean points, mass-points, cells, even sense-data or common physical objects. Of course, the greater and greater complexity of entities involved will swell the analytical packages of their properties and relations (analytical relative to the theory in question) and enforce more and more massive stock of predicates to be interpreted in an appropriate way.

This general schema may seem to suggest the *priority* of proto-ontologies and extralogical theories over an applied PL_1. What this schema does stress, however, is the familiar idea of the subject matter *neutrality*[8] of a pure logical theory: PL_1-pure works equally well for any domain of objects, since, whatever the nature of these objects, they must "obey" the legitimate laws or rules of PL_1-pure. An applied PL_1 incorporates systems of objects specified by the respective extralogical (mathematical, physical, metaphysical, etc.) theories and thus serve as a uniform framework for the discourse and reasoning about any kind of objects. While PL_1-pure deals only with the skeletons of objects, a PL_1-appl. treats of more or less full-bloodied individuals. It is also to be noted that our discussions do not support the idea of *reducibility* of logic to arithmetic, or vice versa. First of all, first-order logic is only one among the logical theories (however crucial it may be) and, secondly, talking about its U is only a very limited way of covering the full content of PL_1. Obviously, the central problem in this context is the problem of the legitimate interpretation of quantifiers and sentential connectives.[9]

V. Set theoretic proto-ontology

The relationship between logic and set theory has rightly attracted considerable philosophical attention.[10] G. Cantor's too cavalier treatment of a set as any collection of objects of our thinking and imagination led, by way of Frege's foundational works, to the formulation of Russell's para-

[8] Of course, this neutrality must be qualified, for it does not apply to logical constants themselves; in this respect see interesting remarks of G. S. Boolos (1975), especially 517f.

[9] Compare, e g , what M. Dummett says about the interpretation of quantifiers and sentential connectives in (1977), 22f. etc.

[10] A. A Fraenkel (1966) gives a good overview; among more recent contributions one has to mention W. Craig (1979) and S. MacLane (1981) (he talks about the one-sidedness of the "Grand Set Theoretic Foundation").

dox, i.e. to the discovery that some "sets" are not legitimate entities. Zermelo-Fraenkel axiomatization of set theory, and later the axiom systems of von Neumann – Bernays – Gödel, attempted carefully to define the notion of set implicitly (via the axioms), and also to avoid such illegitimate entities as the set of all sets. The history of the notion of set (class) warns us therefore to be especially careful in dealing with a proto-ontology relevant to set theory. At the same time, since set theory is couched in the language of PL_1, the study of the relationship between these two systems acquires a special significance.[11] In Zermelo – Fraenkel version of set theory, e.g., individuals are sets, that is, both the domain and the counterdomain of the (primitive) membership relation ε are made out of sets. This is not the case of the original Zermelo's axiomatization (1908) where besides sets non-sets elements or individuals (*Urelemente*, atoms) are permitted, though not in the counterdomain of the membership relation. And, finally, in the von Neumann – Bernays – Gödel axiomatization also classes are introduced, permitted only in the counterdomain of the membership relation (no *Urelemente* are allowed).

Our pragmatic representation of the situation must therefore consider these various alternatives. It is interesting, however, to notice also the following possibility:

(3) $C(X, \{a\}, O) \rightarrow D(X, \{a\}/U, PL_1\text{-pure})$,

where X is choosing sets $\{a\}$ of objects from the proto-ontological domain and postulating such sets as members of U of PL_1-pure. As in the Zermelo – Fraenkel system, the objects a constituting sets – Zermelo's *Urelemente* – lose their status as individuals and one gets here a completely new ball game within the PL_1-pure. Of course, the question remains whether the membership relationship is logical or extralogical; if it is extralogical, we have here a system of PL_1-appl., the individuals being sets *imported* from a set theory. In such case the parallels with an arithmetical theory are quite obvious. Again, sets are already specified objects, whereas the individuals of PL_1-pure would remain unspecified, as before. In addition, there will not occur a clash between the logical notion of class (as an entity or quasi-entity obtained via monadic predicates) and the mathematical primitive notion of a set.

[11] See A. A Fraenkel, A Hıstorıcal Introductıon, ın (1958), also (1966) Boolos (1975) confırms thıs claım. See also S. MacLane (1981).

The emphasis on the fundamental role of "non-set" individuals in logical inquiries led Russell and the early Wittgenstein towards the search for *logically simple objects* and eventually stimulated Russell to regard classes as mere logical fictions.[12] This opened the way towards the theory of virtual classes and relations (Quine, R. M. Martin). No doubt, when one is looking for the illustrations of logically simple objects, Euclidean points are lending themselves for this role more easily than "internally divided" and complex sets. In this context, the original Zermelian *Urelemente* are more suitable objects to be postulated as members of U of PL_1-pure.

VI. Intended interpretations of S

It is a familiar peculiar phenomenon that one and the same (consistent) formal system S can have various interpretations. Hence we talk, for instance, about the standard and nonstandard interpretations of Peano's arithmetic. The standard interpretation is usually identified with the intended one. This fact was mentioned when we have introduced the pragmatic predicates A, C and D. It seems that a person X is choosing objects *a* from O not just for the sake of postulating them mechanically as members of U of, say, PL_1-pure, but rather because X follows an *intentional* plan which is governed by the expectations already embodied in the syntactic part of S. The distinction between different syntactic categories has not been drawn blindly by X; naturally, it is anticipated that it will be followed in the semantic interpretation as well. So it is normally intended that the individual variables of PL_1-pure will be assigned values amounting to *basic entities* (whatever their nature) – let us call such objects *formal individuals*. Through the application of monadic and polyadic predicates to these mutually independent formal individuals, properties and relations are going to be attached to them. Yet note what can happen to these formal individuals in nonstandard interpretations of PL_1-pure: they can be turned into a) sets, b) events, c) states of affairs (facts), d) properties (bundles of properties), e) propositions, and so on.[13]

The choice of sets has already been discussed and its pitfalls are quite obvious. The possibility of choosing *events* as individuals was well rec-

[12] See e g B. Russell (1918), 266f Compare also S. E Boer (1972 – 73), 206 – 208. On virtual classes, see e g. R M Martin (1969).

[13] Any discernible entity can become an individual, as witnessed in N. B. Cocchiarella (1972), 165 – 168 (but his system is a standard second-order logic). On the choice of propositions, see F. B Fitch (1971), 99 – 103.

ognized by the pioneer of the logic of events H. Reichenbach.[14] However, if events make U of PL_1-pure, they will be treated as mutually independent, similarly like the individuals of the thing type (following Reichenbach's terminology). The difference will be exhibited only in an appropriate PL_1-appl., where the interpretation of predicate constants and individual constants must fit the requirements of our intended talk about events (events can hardly be green or odd without a lot of twisting or trimming).

Similar problems would apply to other possible choices. For instance, in the case of *states of affairs* (facts) a possible collision with the semantic interpretation of sentential variables may occur, and the like. The same argument can be applied to the acceptance of *propositions* as special entities. But these problems reach beyond the scope of this essay.

VII. Mereological proto-ontology

Mereology or calculus of individuals (CI), elaborated by S. Leśniewski, N. Goodman, and others,[15] offers interesting metaphysical questions. The basic relation of CI – the part-whole relation – is utilized by nominalistically inclined philosophers to unseat the set-theoretic membership relation. Individuals of any degree of complexity might then be members of U of CI, being generated by operations such as *fusion*, which permits also non-contiguous entities (like the U. S. A. constituted by Alaska, Hawaii and the other states). Unlike the standard individuals of PL_1-pure, the mereological individuals are therefore not independent on each other, unless one again considers merely the atomic individuals having no proper parts (analogous to Zermelo's *Urelemente*). Perhaps these are the entities imported from the proto-ontology of CI, requiring, however, a high level of abstraction. Of course, the predicates within CI are then applicable to both these simple individuals and the complex ones, constructed by permissible operations (basically Boolean). As usual, the questions of the minimal object (the *null* individual) and the maximal legitimate object (the all-embracing individual) are of great metaphysical significance.

It is also possible to take the entire domain of mereological individuals and to postulate U of PL_1-appl. as constituted out of them. This is another

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14 H Reichenbach (1948), 266 – 274 A more recent theory of events is presented in R. M Martin (1978)

15 See commenting articles on S. Leśniewski's systems, such as V F Rickey (1977), 407 – 426 N. Goodman's calculus of individuals, presented in (1966), is well known.

variation on the topics under discussion, with all the complexities of a pragmatic choice involved. This situation might be expressed as follows:

(4) $C(X, a, CI) \rightarrow D(X, a/U, PL_1\text{-appl.})$,

meaning "X chooses an object (individual) from the domain of objects of the calculus of individuals, and postulates it as a member of U of PL_1-appl.". Here X's apprehension of *a* would include his/her ability to test whether *a* has been correctly construed in accordance with the legitimate operations of CI. The import of these mereological individuals will also enforce the acceptance of appropriate mereological predicates, i.e., these individuals will enter PL_1-appl. with the analytic package of properties and relations as to CI. Evidently this is now a well established uniform pattern.

VIII. General remarks on pragmatic operations and proto-ontologies

In our inquiry proto-ontological objects are treated as merely *given* (even in the case of their previous intuitionist construction). These objects are not regarded as primitive (undefined) objects of formal systems, unless they are chosen and postulated as such by a person X. Usually the primitive (undefined) objects of formal systems are viewed as given, yet, owing to our pragmatic connections between a proto-ontology and a formal system (between O and U of S), we characterize in this way only proto-ontological objects. The discernibility of proto-ontological objects enables X to *apprehend* them, *choose* them (whether individually or collectively), and finally to *postulate* them as members of U of a system S. Once entrenched in a U of S, these objects *a* may produce additional, defined objects (say, recursively defined or generated).

However, if the objects *a* are imported into S from another (interpreted) formal system S′ (say, into PL_1-appl.from N), they come with an *analytic* package of characteristics (established in S′, e.g., in N) that forces X to interpret the predicates of S correspondingly. Then X's awareness of such package (his/her ability to apprehend these characteristics) and the coherence of X's interpretation of the respective predicates of S should be tested and expressed in additional pragmatic operations. Of course, the objects imported from S′ to S may be of different degree of complexity and mutually dependent. It seems that a more economical alternative is X's choice of the subdomain of simple, mutually independent objects (i.e., of the genuine primitive objects of S′) from which all other objects could be generated according to appropriate definitional rules. In this respect, "bare particulars", simple events, atomic mereological individuals, Zermelo's *Urelemente*, etc. are such simple, mutually independent objects. There is no guarantee, however, that such logically simple objects do exist in the actual world; the aforementioned proto-ontology of PL_1-pure initially contains full-blooded individual objects and not bare particulars, which are conceptual products of X's abstractive power (at least so I believe in holding a non-Platonic realist position). Although X has no guarantee that there actually are such simple objects, he/she can choose them from the relevant proto-ontology by apprehending its discernible entities as being stripped of any characteristics besides *the simplicity of an object*. In this respect, PL_1-pure may be involved in any formal system the object language of which contains object-expressions ("simple" individual variables and constants), that is, in the arithmetic of natural numbers N, in Zermelo – Fraenkel set theory, and so on.

There exist many additional problems of pragmatic operations and proto-ontologies referring to current issues in the philosophy of logic. Among such issues one can single out the controversial status of possible worlds and possible objects (modal logics), the intricacies of logical types (simple type theory) and temporal objects (tense logic), and many other questions. It would certainly be interesting to discuss these questions in our present context, yet I can here merely announce them in a programmatic manner and leave them for another occasion.

IX. Logic and metaphysics

Now I would like to state how the results of our discussion may affect the ties between logic and metaphysics. Since I regard proto-ontology merely as a realm or system of objects[16] which provides the resources for the postulated objects of interpreted formal systems, it is only a basis for the formulation of a well-articulated metaphysical theory. The objects of such full-fledged metaphysical theory might then be postulated as the individuals of a PL_1-appl. (or of another logical system), bringing with them an analytic package of characteristics (analytic as to the metaphysical theory in question). A comparison between the proto-ontological im-

[16] Such systems of objects are characterized by S. C. Kleene in (1964), chapter II, par. 8. See also A. Riska (1982).

pact on the formal individuals of PL_1-pure and the individuals of PL_1-appl., on the one hand, and these analytic packages coming from a respective metaphysical theory, on the other hand, would show how much this theory contributed to our knowledge of the original proto-ontological realm. Perhaps logic can be viewed as the articulation of the fundamental formal features of proto-ontological objects without which no discourse or theory would be possible. I do not believe, however, that logic imposes such features upon these objects in a Kantian manner, however tempting it may be nowadays to hold such a position in a linguistic disguise. Of course, an acceptance of a basically realist position forces us also to explain carefully the conceptual abstractions and constructions in the process of transforming proto-ontological objects into, say, formal individuals. In this sense logic could also be viewed as a theory and method of the construction of a well-articulated metaphysical theory.[17] Different logical theories will then help to handle diverse aspects of metaphysical problems. The important German philosopher and logician H. Scholz, whose contributions to logic and metaphysics are so extremely valuable, expressed once the opinion that "the new logic could also be interpreted as a new metaphysics."[18] I would hesitate to go as far as to make this bold identification; nevertheless, it seems to me that a viable contemporary metaphysics cannot be constructed without the essential intervention of contemporary logical theories. Of course, the effectiveness of such intervention depends also on the clarification of the overt or covert assumptions of logical and other theories: obviously, our discussion of different proto-ontologies attempted to serve this purpose. The early Wittgenstein liked to repeat that "logic must take care of itself."[19] Well, a healthy logic takes care of itself by revealing its own roots as well as by showing how it fits into the great scheme of things.

Department of Philosophy
St. John's University,
New York, N.Y., U.S.A.
riskaa@stjohns edu

[17] In spite of all his distaste for metaphysics, R Carnap embraced this idea, I believe, in his grandiose project of *The Logical Structure of the World* (1967). Of course, the spiritual father of this idea is B. Russell

[18] H. Scholz (1961), 381 See also his (1941), just as (1938).

[19] L Wittgenstein (1969), 2e

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