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Against Fantology

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1. Introduction

A dark force haunts much of what is most admirable in the philosophy of the last one hundred years. It consists, briefly put, in the doctrine to the effect that one can arrive at a correct ontology by paying attention to certain superficial (syntactic) features of first-order predicate logic as conceived by Frege and Russell. More specifically, it is a doctrine to the effect that the key to the ontological structure of reality is captured syntactically in the 'F*a*' (or, in more sophisticated versions, in the 'R*ab*') of first-order logic, where 'F' stands for what is general in reality and '*a*' for what is individual. Hence "fantology". Because predicate logic has exactly two syntactically different kinds of referring expressions—'F', 'G', 'R', etc., and '*a*', '*b*', '*c*', etc.—so reality must consist of exactly two correspondingly different kinds of entity: the general (properties, concepts) and the particular (things, objects), the relation between these two kinds of entity being revealed in the predicate-argument structure of atomic formulas in first-order logic.

Fantology is a twentieth-century variant of linguistic Kantianism, or in other words of the doctrine that the structure of language (here: of a particular logical language) is the key to the structure of reality. Classical fantologists were Frege, Russell and the Wittgenstein of the *Tractatus*, yet the work of almost all twentieth-century analytical philosophers bears traces of fantological influence, though this influence is of course more notable in some circles (for instance among the logical positivists in Vienna) than in others. Where the early fantologists argued explicitly that first-order predicate logic mirrors reality, present-day philosophers are marked by fantology only tacitly, through their use of predicate logic and of ways of thinking associated therewith. David Armstrong seems, in this respect, to be a borderline case.

The dark force of fantology has spread its tentacles also beyond the realm of philosophy to embrace much of what goes on in computer science under headings such as 'knowledge representation' and 'conceptual modeling'. The full story of these influences must be left for another day, but for a preliminary accounting see my (2004).

2. History

Many of the ontological doctrines which I associate with fantology in what follows have recognizable roots in the work of philosophers such as Plato, Locke, Leibniz, Hume, and Kant, whose ideas were of course formed well before predicate logic was conceived by Frege. But it was, I suggest, the very success of Frege's project in the *Begriffsschrift* which led just these doctrines of just these philosophers to be taken up within the canon of analytical philosophy (a branch or mode of philosophy which was, after all, for a long time conspicuously uninterested in its own philosophical past).

The language of predicate logic is richly expressive, and I hasten to emphasize from the start that it is of course possible to use predicate logic in one's philosophical work without falling victim to any of the adverse effects of fantology. (I shall indeed conclude with one example

of how predicate logic can be used in order to thwart these very effects.) My goal is thus not to criticize predicate logic. Rather, it is to bring forward examples of the ways in which predicate logic has been standardly used in order to build a new sort of tunnel through the history of post-Fregean philosophy. My remarks should accordingly be understood in this historical light. If Frege is the grandfather of analytical philosophy, then it is the influence in ever widening circles of Frege's *logic* which has confirmed his special place in the analytic-philosophical pantheon. Frege's signal achievement lies in his having inaugurated the era of logical rigor—to the extent that we can now all agree that logical rigor is an indispensable requirement of all good philosophy. But this signal achievement was for a long time marred by its association with an overestimation of the power of a relatively simplistic type of logico-linguistic analysis to resolve ontological problems. Exposing some of the effects of this overestimation should allow us to understand the development of analytical philosophy in a new way, and to bring to light aspects of this development which are normally hidden.

3. The secret doctrine

Fantology is a doctrine that rarely dares to speak its name. (That fantology should be conceived as a secret doctrine is indeed one reading of the concluding sentence of Wittgenstein's *Tractatus*.) When Wittgenstein gives voice to the doctrine, it reads like this:

> Most of the propositions and questions of philosophers arise from our failure to understand the logic of our language. (4.003)
>
> Propositions show the logical form of reality. They display it. (4.121)
>
> Thus one proposition 'fa' shows that the object a occurs in its sense, two propositions 'fa' and 'ga' show that the same object is mentioned in both of them. If two propositions contradict one another, then their structure shows it; the same is true if one of them follows from the other. And so on. (4.1211)
>
> The propositions of logic describe the scaffolding of the world, or rather they represent it. They have no 'subject-matter'. They presuppose that names have meaning and elementary propositions sense; and that is their connection with the world. It is clear that something about the world must be indicated by the fact that certain combinations of symbols—whose essence involves the possession of a determinate character—are tautologies. This contains the decisive point. (6.124)
>
> The exploration of logic means the exploration of everything that is subject to law. And outside logic everything is accidental. (6.3)
>
> Just as the only necessity that exists is logical necessity, so too the only impossibility that exists is logical impossibility. (6.375)

Compare also Russell: "Philosophy, if what has been said is correct, becomes indistinguishable from logic as that word has now come to be used." (1917) And: "logic is concerned with the real world just as truly as zoology, though with its more abstract and general features." (1919)

4. The spreadsheet ontology

We can gain some impression of what more recent fantological philosophy looks like by considering what Armstrong was once pleased to call his "Spreadsheet Ontology" (see Armstrong 2004, a work published only in French).

	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	…
a			x		x				x	x	x						
b		x	x								x	x				x	
c		x	x										x	x	x		
d						x										x	
e	x					x						x				x	
f	x					x					x		x		x		
g			x			x					x	x	x				
h							x							x	x	x	
i			x			x				x			x				
j			x		x									x	x	x	
…																	

Figure 1: Armstrong's Spreadsheet Ontology

Reality, we are to suppose, is made up of concrete individuals (*a*, …) plus abstract 'properties' or 'attributes' (F, …). The rows of Armstrong's spreadsheet (see Figure 1) then correspond to the individuals, the columns to the properties. When the spreadsheet has been filled in completely—a task which Armstrong seems to have believed could be left to the physicists of the future—then we will be able to read off for every object a list of its properties and for every property a list of the objects to which it applies, and in this way gain a complete assay of reality.

At the time when he advanced his Spreadsheet Ontology, Armstrong seems to have believed not only that such an assay is at least in principle possible, but further that its provision is the very goal of physics in its march towards future perfection. Wittgenstein's *Tractatus*, too, of course, expresses a vision along similar lines, his elementary propositions corresponding to the cells of the spreadsheet after the latter has been modified to allow some extra room for relations. David Lewis and the Carnap of the state descriptions enrich the vision by having many spreadsheets, one for each 'world', the worlds themselves enjoying a stunning mathematical elegance in virtue of the fact that they are identified with sets of propositions of simple (F*a*, R*ab*, etc.) forms.

5. The picture theory

Fantology sometimes takes the form of a thesis according to which the language of standard predicate logic can serve the formulation of the truths of natural science in a uniquely illuminating way (its syntax mirrors, after all, the very structures in reality which such truths represent). So Quine, with his doctrine according to which the ontological commitments of a theory become evident only when the theory has been regimented in fantological fashion.

A similar thesis already underlies the picture theory of the *Tractatus*, where the syntax of first-order predicate logic is, as one says, a "great mirror" (Feibleman 1958). It underlies the logical atomism of Bertrand Russell, including the central thesis according to which all form is logical form—a thesis which, be it noted, leaves no room for a discipline of formal ontology as something separate from formal logic.

In this connection it is worth bearing in mind that the term 'formal ontology' was originally coined by Husserl (1913/21) to signify that branch of philosophy which deals with the interconnections of *things* (with objects and properties, parts and wholes, relations and collectives)—as contrasted with formal logic, which deals with the interconnections of *truths*, with consistency and validity, disjunction and entailment, 'and' and 'not'. There is no *a priori* reason to suppose that these two families of interconnections should be identical. Both are 'formal'—which means (as Husserl sees it) that they are domain-independent structures realizable in principle in all material spheres of reality. The mereologist's 'part of' reflects a formal-ontological structure in light of the fact that there is no restriction on the sorts of objects which can enter into relations of part to whole. 'Or', similarly, reflects a formal-logical structure, because the relation of disjunction can join together assertions without restriction on their content. In other respects, however, the two sorts of structure are radically distinct—yet fantology rides roughshod over the differences between them.

There are two central components to the formal ontology Husserl himself presented in his Third Logical Investigation: the theory of part and whole (or mereology), which has received some considerable attention in recent years (Simons 1987), and the theory of dependence—that is to say the theory of those links between entities of different types in virtue of which entities of one type cannot, as a matter of necessity, exist without some further entity of another, different type (Johansson 2004). These necessary relations between discrete existences obtain most conspicuously between entities—for example processes or qualities on the one hand and their bearers on the other—which enjoy different ways of existing in reality. The neglect of necessary dependence relations in fantological circles flows from the fact that such distinct ways of

being were themselves commonly neglected. This neglect in turn is one consequence of the fantologists' assumption that 'existence' is univocal—it is in every case a property of what Frege called concepts or functions—and is captured in the '∃'. And if existence is analyzed as a property of concepts, so supervenience is analyzed (e.g. in Kim 1984) as a relation which has concepts as its relata.

6. The special case of mathematics

The term 'formal' is of course used also in another sense—corresponding to the use of the term 'symbolic' in the phrase 'symbolic logic'. Fantology can in this light also be formulated as a doctrine to the effect that formal ontology is properly included within the domain of *symbolic* logic as this was understood by Frege or Russell. The historical background to this doctrine lies, I believe, in the apparent successes of early analytical philosophy in the domain of the philosophy of mathematics, which seemed to many in the years following the publication of *Principia Mathematics* to lend a great deal of support to the proposition that, when once we have fixed on a proper symbolism for the expression of the truths of mathematics, then no further mathematical work would remain to be done. Wittgenstein generalized this assumption: when once we have fixed on a proper symbolism for the expression of the truths of natural science, no further work for *ontology* will remain to be done.

Some early fantologists went still further in embracing an even stronger thesis according to which *all necessary truths*—and thus, on some accounts, *all the truths of philosophy*—could be analyzed as truths of logic. In the Vienna circle, for example, it was working dogma that the apparent successes achieved by Frege and Russell in reducing truths of mathematics to truths of logic would inevitably be repeated elsewhere, in a march towards total victory of logical reduction in all domains of inquiry, so that it would one day be possible to read off without restriction the structure of reality from the symbolism of logic.

7. First-order logic as *characteristica universalis*

The language of first-order logic—especially in the form it was given in *Principia Mathematica*—thus came to represent the rebirth of the old Leibnizian idea of a universal characteristic. But while Frege and Russell (and Whitehead) did indeed successfully demonstrate that this language may lay some claim to the power of a characteristic when it comes to the formulation of many of the propositions of mathematics, it is by now surely evident that it can lay no such claim in regard to other domains.

One reason why fantology works so well in mathematics is because mathematical entities do not exist in time and space (this is why mathematics is a domain in relation to which a Platonistic ontology has much to be said in its favor, and why mathematics is a domain in which it may even make sense to identify necessity with logical necessity and law with logical law). When philosophers have turned their methods to the necessary relations in other, non-mathematical domains, however, then fantological reductions have remained beyond their grasp. The logical positivists' expectation that it would be possible to demonstrate the logical nature of such necessary truths as 'Nothing can be red and green all over' were uniformly dashed. But

this failure went largely unnoticed, to the degree that many continued to assume that the needed reductions had indeed been successfully obtained.

The truths of causal necessity received a different treatment. So closely did some adhere themselves to the doctrine according to which all necessity is logical necessity that in order to save the good name of fantology they saw fit, when applying this doctrine to the realm of causality, to embrace the nuclear option of Humeanism. Causal relations would break the bounds of fantology. Hence, causal relations do not exist.

8. All generality belongs to the predicate

Consider some typical sentences of science:

Action and reaction are equal and opposite.
The electron has a negative charge.
The ribosome is the subcellular unit responsible for protein synthesis.
The heart is a part of the cardiovascular system.

Here nominal expressions are used as a matter of course to refer to *what is general in reality*. In the syntax of first-order logic on the favored fantological interpretation, in contrast, all generality belongs to the predicate: the '*a*' in 'F*a*' (and thus the '*x*' in 'F*x*') is a mere (meaningless) name, a matter of pure denotation.

Note that, as is made clear already by many of the examples used by Frege himself, nothing in logic prevents the use of names to refer to ideal or general objects, and nothing in logic says that names are meaningless or that they can refer only to individual objects. Rather, these assumptions are the result of a philosophical interpretation.

9. Reality is made of atoms ('bare particulars')

Those advocates of fantology who allow only logically simple names are then led by the doctrine which identifies ontological form with logical form in the direction of one or other atomistic conception of reality. This atomism is manifest in Armstrong's Spreadsheet Ontology and by his repeated appeals to the basic truths of some future perfected physics. But it is demonstrated most starkly in the *Tractatus*, which denies that there exist complex objects at levels of granularity above the level of the absolutely simple substances to which the logically proper names of the *Tractatus* are supposed to refer. Wittgenstein seems, indeed, to deny all ontological complexity at levels of granularity above that of the states of affairs which such objects go to form.

Fantology has of course proved conducive not only to atomistic doctrines but also to other, associated forms of reductionism and eliminativism, including Russell's view that proper names refer to sense data. Wittgenstein's assumption to the effect that all elementary propositions are logically independent of each other likewise consolidated a resistance to holistic views about the structure of reality (thus to patterns, laws, systems). Fantologically inspired philosophy has thus also faced difficulties in doing justice in its theories to the objects of biology.

Where fantology departs from atomism at all, it has normally embraced doctrines of complexity powered by set theory—and of course the central role of set theory in analytical philosophy itself has fantological roots. Alternatively, it has seen virtue in theories of 'bundles'—resting again on the assumption that the key to good ontology lies in breaking down reality into its smallest bits.

10. … and sets

When applied as the exclusive tool of ontology, set theory amounts to the reduction of all complexity to cumulative combinations of zero or more *Urelemente*. Set theory can in fact be identified as a general theory of those mathematical structures which arise when objects (of whatever sort) are conceived as being unified together *ad libitum* on successively higher levels, each object serving as member or element of objects on the next higher level. The problem is that, in many spheres which we might wish to subject to ontological analysis, no candidate basic level of *Urelemente* can be identified. In some spheres, moreover, there is no unidirectional (upward) growth of complexity generated by simple combination. The pitch, timbre and loudness of a musical tone, for example, are not *Urelemente* which can exist in separation from one another and somehow become combined in the context of the larger whole.

A further problem with set theory is that it deals with combination *per accidens*—drawing no distinction of structure between, say, the set of enzymes, the set of planets in the solar system, and the set of persons whose surnames end in 'E'. It places numbers and popes, molecules and galaxies together in combination and thereby fosters a maximally promiscuous use of the term 'object' that has been detrimental to the advance of ontology in analytic philosophical circles in ways too little appreciated.

It seems to me to be an open question whether there is any countervailing theoretical interest from the perspective of ontology to the possibility of such *ad libitum*, universally applicable, and thus necessarily bland, unification. For the concrete varieties of complexity which in fact confront us in our dealings with reality are subject always to quite subtle sorts of constraints, constraints which vary from one type of entity to another. We are, outside the special contexts of mathematical set theory, not interested in *ad libitum* collections, after all—not even when we are making lists. Rather we are interested in collections of objects of given sorts, existing in given contexts or locations.

A further problem—a problem rarely addressed by those who would use set theory as a tool of ontology—is that sets as defined by the pertinent axiomatic theories are abstract entities. They are timeless; they do not change (the set-structure is implicitly defined by certain axioms which are timelessly true). The friend of sets is thereby left with the problem of how he is to connect up the abstracta he countenances on the side of sets with those real concreta with which they are in different ways associated. Even Maddy (1997), who comes closest to providing a solution for this problem, concentrates rather on the epistemological aspects of the propositions of mathematical set theory.

Those who use the jargon of sets in non-philosophical disciplines—for example in classifications of soil types or of diseases—commonly suppose that they can rely on set theory to provide the needed formal support for their work. They do not recognize that the mathematical theory of sets deals with sets as abstract entities artificially removed from the realm of time

and space. This is clear where the sets in question are pure sets (sets built out of the empty set as basis), with no admixture of *Urelemente* at all. But it holds even where the sets in question—for example the set of all items of furniture in a given room—have physical objects as their elements. For the mathematical set-forming operator has the peculiar effect of sealing off real-world entities from the vagaries of time and space. The set {Socrates} exists (in the timeless sense appropriate to abstract mathematical entities) even though Socrates himself passed out of existence long ago.

11. Particulars are unknowable

It is not only all generality, on the fantological view, that is confined to the predicate, but also (at least on some versions of fantology) all connotation, all meaning. Names are mere ciphers—a matter of pure denotation. Thus if all truths are to be capable of being expressed in predicate-logical terms, then this implies a noumenal view of what the classical fantologists liked to call 'bare particulars', an outcome in fact explicitly embraced by Quine (Oderberg 2005). And if (as on some standard fantological views) universals are identified as mere sets of particulars—or with functions between such sets of particulars and what some fantologists are pleased to call 'worlds'—then this implies a noumenal view of universals, too. We cannot express in our theories what particulars, or universals, are like; at best we can capture only a certain structure (or pattern or net or mesh) which reality somehow realizes. We cannot know what numbers are like, because even in second-order Peano arithmetic we cannot justify identifying the natural numbers with any specific omega sequence.

In the hands of some, the formal limitations on our capacity to specify such structures univocally (for example as implied by the Löwenheim-Skolem result) are held (incredibly) to be a sign of a psychological incapacity on our part to understand the corresponding objects. Here again (and now for spurious technical reasons) fantology connives to Kantian conclusions.

In fantological philosophy of natural science, the world itself is unknowable. At best we can appeal in neokantian style to physics as it will exist in some never quite realized future state of epistemological perfection—a physics in which all of the differential equations will somehow have disappeared. Fantology thus implies, as in the hands of Carnap, a noumenal view of science.

12. Predication is functional application

Another strand in the fantological doctrine is the thesis according to which, in order to understand monadic properties, it suffices to understand monadic predication. Frege held that when we assert, for example, that John is wise, then we are not ascribing to John some quality (of wisdom). Rather, we are applying a certain function from objects to truth values, and asserting that the value of this function for John as argument is a certain designated object called 'the true'. In this way Frege's object/function distinction rides roughshod over two traditional ontological distinctions, between *substance* and *property* and between *particular* and *universal*.

On more traditional accounts of predication, qualities like wisdom or hunger or temperature can be coherently applied only to entities of certain restricted sorts. One important corollary

of Frege's account of predication, however, is that it applies indiscriminately to entities of all kinds. It thereby yields a single, beautifully elegant, unified (and bland) account of properties and predication, which extends indiscriminately to entities of all sorts—in spite of the fact that there is nothing ontologically in common between, say, the evenness of the number 2 and the negative charge of an electron. This allows Frege himself to build nonsense truths like 'The square root of Napoleon's mother is the false.' In this way, however, the generality and rigor of Frege's unified theory is bought at the price of ontological clarity.

A further problem with Frege's theory becomes apparent when we consider its application to the case of relations. That *a* stands in relation R to *b* is parsed by Frege as meaning: the function R when applied to the ordered pair <*a*, *b*> as argument yields *the true* as value. In virtue of what, however, does this latter proposition hold, if not in virtue of the existence of some relation (in the more traditional, properly ontological sense) between *a* and *b*?

Occasionally Platonistic doctrines are offered, for example by Bealer, Butchvarov, Hochberg or Plantinga (see Menzel 1993) as alternatives to the Fregean account of predication. Such doctrines are however still too closely wedded to the 'F*a*' analysis, so that they, too, have gone hand in hand with many of the simplifications otherwise characteristic of the fantological approach.

13. The vanishing copula

The most important of these simplifications is the rejection of the venerable Aristotelian distinction between two kinds of predication:

in the category of substance
John is a human being.
Henry is an ox.

in the category of accident
John is hungry.
Henry is awake.

The difference here turns on the fact that, if John is a human being, then he is a human being at every time at which he exists, and not for accidental reasons but because it is, as one says, part of John's essence that he is a human being. If, on the other hand, Henry is awake, then he will cease to be awake at some time in the future. This distinction reflects what is, for Aristotle and for his successors, a fundamental ontological distinction, between *what* a substance is (its essence), and *how* it is (the accidents which accrue to it) at some given point in time. Substances and accidents are for Aristotle categorically distinct kinds of particulars.

For Frege and for his fantologist successors, this distinction has become invisible: the copula, on which the distinction rests, has become bundled into the predicate (Oderberg 2005), which is treated syntactically always in the same uniform kind of way. This implies in turn that the fantologists have little room in their thinking for the traditional distinction between property universals and kind universals, just as they have little room for the notion of essence. Here again the nuclear option is preferred—the idea being that it would be possible to save the

fantological doctrine by denying the existence of those entities which cause it problems. Many heirs of the fantological world view have in this way found it possible to avoid the problems raised for their doctrines by apparent examples of true predications in the category of substance by denying the existence of substances.

14. All particulars are bare particulars

For the classical fantologist, all generality belongs to the predicate, all particularity belongs to the name. From this it follows that analytical philosophers were until relatively recently reluctant to admit into their ontologies tropes, or individual accidents, or events or actions, or other entities falling outside the two privileged categories of property and object. Of the four corners of Aristotle's ontological square (see Figure 2), the classical fantologists have accordingly admitted only two.

	Substantial	**Accidental**
Universal	Second substance *man* *cat* *ox*	Second accident *headache* *sun-tan* *dread*
Particular	First substance *this man* *this cat* *this ox*	First accident *this headache* *this sun-tan* *this dread*

Figure 2:
Aristotle's Ontological Square (simplified from Angelelli 1967; see also Lowe 2002).

If John has a headache, then the fantological assay of this fact—be it a matter of functional application, or of ascription to an object of a general property—involves no appeal to anything like *the headache which John has*, *which has lasted for two hours,* and *which he is attempting to cure by taking aspirin*.

15. A peculiar insensitivity to time

Because fantologists think it fitting to deal with predications about empirically existing objects in just the same way that they deal with predications about mathematical objects, this means that—because it is predications of the latter sort that wear the ontological trousers—they have developed no clear way of dealing with time. Fantologists such as Carnap were content to conceive the passage of time in terms of a sequence of static worlds, one for each time, in which all that is dynamic has been carefully eliminated.

The predicate logical 'F*a*' had its origins, after all, in the work of Frege, who was concerned first of all with the truths of mathematics. And Frege's logic does indeed work very well, in its way, for the formulation of many types of mathematical truths. When it comes to truths about things marked by change, however, then it needs to be extended by some sort of new machinery.

The three alternative ways of doing this within a still recognizably predicate-logical framework are by now well known (see e.g. Lowe 2002a, 43f). 'F holds of *a* at *t*' can be parsed in three ways:

(1) the property F holds-at-*t* of object *a* (the copula is indexed by times);
(2) the property F is a relation between object *a* and time *t*;
(3) the property F holds of a new special entity called 'a_t'or '*a*-at-*t*' (an object *stage* or *phase* or *slice*).

That none of these alternatives for representing time has established itself as victor over the others turns on the fact that each involves a heavy price.

The first, which is sometimes called the adverbial solution, involves too great a departure from fantological orthodoxy—holding is no longer capable of being interpreted as functional application in the standard mathematical sense; rather it comes to signify something more like inherence or exemplification as conceived by Aristotelians. Indeed, Lowe sees it as understandable why alternative (1) "should have been overlooked, at least by philosophers trained to think in terms of the categories of modern quantification or predicate logic, as it is called. For such logic simply has no place for adverbs." (2002a, 47)

The second seeks to simulate the temporal nature of holding by viewing each contingent property as a relation to a time. The problem here is that the result contravenes almost everything that we know about properties of almost all familiar kinds.

The third represents, once again, a nuclear option. It amounts to sacrificing three-dimensional enduring entities for reasons which have to do (at least in part) with the desire to hold on to a trusted syntax. On this third option you yourself do not exist; rather there exists only a sequence of youish phases in continuous temporal succession. (For arguments against such views see e.g. Inwagen 2000.)

Nowadays, philosophers who wish to hold on to the framework of first-order logic in order to formulate their ontological views often advance one or other four-dimensionalist position which denies the existence of three-dimensional (endurant) objects but replaces them not by phases, or stages, but rather by four-dimensional (perdurant) processes. There is not *Bill Clinton*, but rather a certain *process-of-a-Bill-Clintonizing-sort*. This allows the four-dimensionalist to hold on to a timeless version of first-order logic without the need for special temporal variables or operators, since all the denizens of the four-dimensional process plenum have all their properties in timeless fashion. The problem with this view, again, is that it implies that you and I, our cells and organs, the buildings and cities in which we live, do not exist.

16. Poor treatment of relations

The doctrine according to which relations are sets of ordered tuples, while it falls outside the syntactic repertoire of fantology that is here our primary concern, is yet clearly part of the same

stable of views and has similar consequences in the form of denials of ontological distinctions hitherto (and for good reason) accepted as a matter of course.

The tradition found it necessary to distinguish between several radically different types of relations. First there are real material relational endurants, like love or hate, and other relational qualities (for example Jonathan's knowledge of Greek), which, like endurant entities in general, change in different ways while preserving their identity through time. There are real material relational *events*, like wars and conversations, kicks and kisses, relational entities which call for a treatment along roughly Davidsonian lines, like events of every other sort. There are family relations, such as *is consanguineous with* or *is the brother of*, and there are comparatives such as *is taller than* or *is warmer than*.

When binary relations are identified with sets of ordered pairs, then all of these distinct types of relations become identified. What is the adicity of your headache (a relation between your consciousness and various processes taking place in and around your brain)? What is the adicity of the Battle of Waterloo? Does John's being in love with Mary, or being the cousin of Mary, consist in his being, with Mary, a term in an ordered pair belonging to a certain abstract entity in the realm of sets? Which analysis, here, comes closer to reproducing the order of ontological primacy?

Of course it is possible in various ways to resist the identification of relations with sets of tuples in a predicate logical framework. One can insist that, while standard model theory typically employs such sets of tuples as assignments for relational predicates, this does not mean that such sets of tuples must be part of the intended interpretations of theories formulated in the predicate logical language.

Note, too, that at least one relation—the relation of set-membership itself—must remain unamenable to an analysis in terms of the relations-are-sets-of-tuples view. This relation is, in David Lewis's terms, a 'mystery'. (Lewis 1991) From the perspective of many adherents of fantological semantics (*inter alia* in the realm of computer science), we can understand a theory only when we have provided a set-theoretic semantics for that theory and proved consistency, completeness, etc. Clearly such a doctrine can provide no help in understanding set theory itself.

According to Russell's *History of Western Philosophy* the introduction of the new style 'R*ab*' was seen as having initiated a revolution in the treatment of relations and as representing a genuine advance in our understanding which allowed its adherents to overcome the problems which had confronted earlier thinkers, such as Aristotle and the scholastics, who (as Russell says) had been led by their own subject-predicate logic to identify relations with monadic relational properties. The 'R*ab*' was seen as having freed us also from the errors of those, such as Spinoza or Leibniz or Bradley (or Hegel), whose failure to understand relations had led them to embrace monistic or monadological doctrines that were an offence to common sense. As we have seen, however, when applied to the different types of relations with which we are pre-theoretically familiar, the R*ab* account faces considerable difficulties of its own.

There are many other doctrines which have been found attractive by those who fall within the gravitational field of fantology. It is fantology which lent credence to Kim's doctrine (1976), according to which an event consists in an individual's exemplifying a property at a time, a doctrine which assimilates real change to Cambridge change. And indeed, with its reduction of relations to sets of ordered tuples, fantology in general is likewise *ex officio* not in a position to resist the assimilation of real properties (such as hardness or shape) to Cambridge properties (such as being thought about or having never been in witwatersrand).

17. Booleanism

Another problem with fantology, at least on some variants, concerns its treatment of properties as inhabiting a realm structured by Boolean combination. If F and G are properties, then so also are ~F, F ∨ G, F ∧ G, F → G, F ⇔ G, F ∧ ~G, and so on—as if establishing which properties exist in reality were a matter not of empirical science but of logic. (See Meixner 1992 for a particularly severe strain of the Boolean fantological orthodoxy, and Newman 1992 for an alternative view.)

This Booleanism—which is properly at home not in ontology but rather in logic or mathematics—derives from Frege's assimilation of predicates to sentences via his notion of unsaturatedness. Predicates are, as one says, 'open sentences'. At the same time they correspond to what is general in reality (somewhat confusingly called by Frege 'concepts'). The sleight of hand here turns on the fact that what is general in reality is hereby brought within the realm of operators such as *and* or *not*—operators which are essentially linguistic. There are indeed some who think that we can read off the properties in reality by looking at the language we use to talk about it. Kantians and relativists even find such doctrines attractive for reasons which have nothing to do with any influence of fantology. But they are, surely, doctrines which enjoy too many of the advantages of theft over honest toil.

Frege's idea led, by degrees, to a lazy use of the word 'property'. (The fantologist's strong comprehension axiom asserts that there is a property corresponding to every expressible formula with exactly one free variable.) In this way, too, fantology came to be conducive to nominalism (for an ontologist, surely, cannot take seriously properties like: *being non-identical to Socrates*, *being such that 2 + 2 = 4*, *being a unicorn unless sleeping*, *being either not a silverfish or not magnetically charged*, *being green if examined before a certain date*). Set theory, too, of course, is marked by a Booleanism of this sort—a Booleanism which shares part of the responsibility for Russell's paradox. Booleanism is in this way responsible also for the phobia of quantification over properties/universals (for no dangers need arise through such quantification in the absence of Boolean combination). In this respect, too, Booleanism is conducive to nominalism.

The tradition surely had it right when it took for granted the thesis that the question which simple and complex general expressions stand for properties or universals in reality is to be decided in each case only on the basis of special inquiries—for example on the part of natural science. So powerful is the force of Booleanism, however, that even the valiant efforts of Armstrong to fight against it with his 'sparse' or 'non-abundant' theory of universals (Armstrong 1978; see also Lewis 1983) are thus far still a minority taste among analytical metaphysicians.

So powerful, indeed, is the solid wall of Booleanist orthodoxy in the philosophy of the twentieth century that its penetration on the part of Armstrong comes close to constituting a miracle of modern intellectual history. Note, though, that this magnificent achievement did no more than bring him back to the point where Aristotelians had been from the very start.

18. No room for dependent continuants

Davidson, too, with his ontology of events, did much to break down fantological orthodoxy. His quantificational analysis of sentences about occurrents (actions, events) was an important

step forward not least in the area where logic meets linguistics: it meant that those linguists who had thus far been too heavily influenced by fantology were finally able to deal coherently with verbs. As analytical metaphysicians have in recent years increasingly turned their attention to powers, qualities, roles, conditions, functions, dispositions, and so forth, they have thereby extended the Davidson-style analysis of occurrents into the realm of dependent continuants. Sadly it is still in too many quarters fashionable to talk indiscriminately of "tropes" in this connection (reflecting, once again, the fact that fantology encourages an undiscriminating representation of all entities not belonging to the category of independent objects). Tropes are individualized *properties*—but properties as fantologically conceived, which means: properties conceived through the running together of all that is expressed by means of the 'F*a*' and the 'R*ab*'.

For exactly as the classical fantologists made too few distinctions in the realm of properties, so their trope-ontologist successors make too few distinctions in the realm of dependent entities, not least in failing to distinguish clearly between dependent *continuants* such as qualities, powers, functions, roles, dispositions, and dependent *occurrents* such as actions and events (Grenon and Smith 2004). When we do make such distinctions, then we arrive at a more adequate ontology, which might be represented in the form of what we can call the Aristotelian Ontological Sextet, as follows:

	Independent Continuant	**Dependent Continuant**	**Occurrent (Process)**
Universal	Second substance *man* *cat* *ox*	Second quality *headache* *sun-tan* *dread*	Second process *copulation* *walking* *thinking*
Particular	First substance *this man* *this cat* *this ox*	First quality *this headache* *this sun-tan* *this dread*	First process *this copulation* *this walking* *this thinking*

Figure 3: The Ontological Sextet

This more adequate ontology goes beyond the Aristotelian ontological square in embracing, in addition to individual and universal substances, also individual and universal *qualities* (as well as *functions*, *dispositions*, etc.), and both individual and universal *processes*. (See Figure 3.) Entities in these categories would be joined together by formal relations such as *instantiation*, *exemplification* and *participation*, as well as by the *part* relation (obtaining for example between the parts of a process and the process whole), and by the *realization* relation (obtaining between a function and the processes through which it is executed).

19. A new, enhanced Davidsonianism

We can solve the problems of fantology in a number of ways. We can follow the route taken by Lesniewski or Sommers and replace fantological logic with a term logic owing more to the older logico-ontological tradition than to the post-Fregean logic of functional application. Or we can follow Wiggins in bringing the copula back into predicate logic, or Gupta (1980) in developing a logic of common nouns. Here, however, we concentrate on a still too little explored alternative, which involves a minimal adjustment to the standard syntax of first-order logic—but an adjustment which nonetheless protects us from its fantological influence—effectively by eliminating the 'F' in 'F*a*' and by radically confining and reconceiving the range of substitution-instances of the 'R' in 'R*ab*'.

We have already noted how, because of its roots in mathematics, Fregean logic yields from within its own resources no satisfactory way of dealing with time and change. Matters were improved in this respect through Davidson's treatment of events, and the idea here is that the latter can be generalized in a radical way to solve the problems of fantology in one fell swoop.

First we expand still further the repertoire of types of entities over which our variables range, in such a way that they embrace both particulars and universals in all the six categories distinguished in our Ontological Sextet (and conceivably also further groups of entities such as temporal instants or spatial regions not here considered). Second, we eliminate all predicates of the 'F' and 'R' style, replacing them with a small number of relational expressions, but confining ourselves to formal ties which, like '=', come with fixed interpretations.

Relations of the sorts we have in mind are represented in Figure 4, as follows:

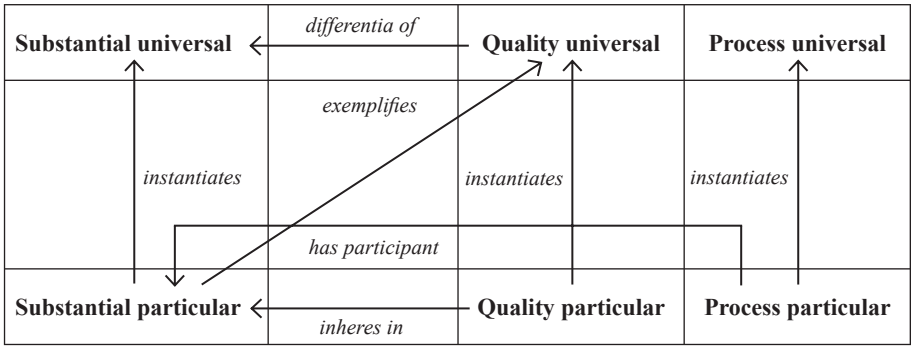

Figure 4. Relations connecting the six different types of entities in the Ontological Sextet

Our restricted vocabulary for predicate logic might then contain a list of predicates along the following lines:

=(x, y), for: x is identical to y
Part(x, y), for: individual x is part of individual y
Inst(x, y), for: individual x instantiates universal y
Inhere(x, y), for: individual x inheres in individual y
Exemp(x, y), for: individual x exemplifies property y

Dep(x, y), for: individual x depends for its existence on individual y
Is_a(x, y), for: universal x is a subkind of universal y
Precedes(x, y), for: individual process x precedes individual process y
Has_Participant(x, y), for: individual thing y participates in individual occurrent x
Has_Agent(x, y), for: individual thing y is agent of individual occurrent x
Realizes (x, y), for: individual process x realizes individual function y

'John is wise', in this vocabulary, becomes: Exemp(John, wisdom)—'wisdom' here is the name of a universal. 'John is a man' becomes: Inst(John, man). 'Man is a subtype of animal' becomes: Is_a(man, animal), and so on. The vocabulary allows us also to formulate a range of axioms governing the formal behavior of the relations thereby distinguished, for example:

$$\text{Realizes}\ (x, y) \rightarrow \exists z\ (\text{Dep}\ (x, y) \wedge \text{Dep}\ (y, z))$$
$$\text{Exemp}\ (x, y) \rightarrow \exists z\ (\text{Inst}(z, y) \wedge \text{Inhere}(z, x))$$

The result is comparable to the vocabulary of set theory in the sense that there, too, we have a restricted number (two) of relational predicates: = and $\in$, both of which are formal, governed by a restricted number of axioms. But while the language we are proposing has a vocabulary structurally very similar to that of set theory, it differs radically in that the formal tie of set-theoretic membership itself emanates from the fantological stable (and thus represents a brutal gliding over of the distinction between logical and ontological form).

20. Predicates do not represent

Our fundamental idea is that predicates (the standard predicates of first-order logic fantologically conceived) do not represent. Even the formal predicates which we allow in our vocabulary do not stand for anything. (They are to this degree analogous to the logical constants as conceived by Wittgenstein.) Rather they are what link together variable and constant terms, which are those parts of the syntax which do stand for something. The logical constants do not represent, and nor, either, do the ontological constants.

Formal ties such as instantiates, part-of, connected-to, boundary-of are for familiar Bradleyan reasons not extra ingredients of being. For if they were entities in their own right then there would arise for them, too, the question: what connects them to their bearers?

The relevant mistake of fantology here lies in the assumption that the 'F' in 'F*a*' stands for something, something that would somehow span the border between what is general in reality (universals, properties, essences) and what is logico-linguistic in the realm of meanings (concepts, propositions). It is from this fateful mistake, introduced into philosophy by Frege (though Plato, too, must bear some part of the blame), that Booleanism stems. Boolean operators such as 'and' and 'or' connect what is logico-linguistic in nature; they do not connect the kinds and universals in reality.

Our approach avoids Booleanism, since we deal with universals, with what is general, via names and not via predicates, and names cannot be joined together *ad libitum* via logical operators. Our approach allows us at the same time to simulate some of the advantages of second-order logic—above all in that we can quantify over universals—without the disadvantage in the

form of the paradoxes which second-order logic is sometimes held to bring in its wake. Our use of names for universals implies also that our framework lends no support to the temptations of nominalism. Above all, however, we are protected from the consequences of fantology, because our procedure keeps the logical and ontological parts of our language rigorously separate.

Our selected formal ties indeed derive squarely from ontology, and logic gives us no clue as to what these formal ties should be. To establish the appropriate list requires extralogical work (Smith *et al*. 2005), just as it requires extralogical work to find out what the universals and particulars in reality are.[1]

References

Angelelli, Ignacio 1967 *Studies on Gottlob Frege and Traditional Philosophy*, Dordrecht: Reidel.

Armstrong, David M. 1978 *Universals and Scientific Realism*, Cambridge: Cambridge University Press.

— "Vérités et vérifacteurs" 2004, in: Jean-Maurice Monnoyer (ed.), *La structure du monde. Objets, propriétés, états de choses*, Paris: J. Vrin, 101-114.

Davidson, Donald 1980 *Essays on Actions and Events*, Oxford: Blackwell.

Feibleman, James Kern 1958 *Inside the Great Mirror: A Critical Examination of the Philosophy of Russell, Wittgenstein, and Their Followers*, The Hague: M. Nijhoff.

Grenon, Pierre and Smith, Barry 2004 "SNAP and SPAN: Towards Dynamic Spatial Ontology", *Spatial Cognition and Computation*, 4: 1, 69-103.

Gupta, Anil 1980 *The Logic of Common Nouns*, New Haven: Yale University Press.

Husserl, Edmund 1913/21 *Logische Untersuchungen*, Halle: Niemeyer, 2nd edition, translated by John N. Findlay*, Logical Investigations*, London: Routledge and Kegan Paul, 1970.

Inwagen, Peter van 2000 "Temporal Parts and Identity Across Time", *The Monist*, 83: 3, 437-459.

Johansson, Ingvar 2004 *Ontological Investigations: An Inquiry into the Categories of Nature, Man and Society*, Frankfurt/Lancaster: Ontos Verlag.

Kim, Jaegwon 1976 "Events as Property Exemplifications", in: Myles Brand and Douglas Walton (eds.), *Action Theory*, Dordrecht: Reidel.

— 1984 "Concepts of Supervenience", *Philosophy and Phenomenological Research* 65, 257-270.

Lewis, David 1983 "New Work for a Theory of Universals", *Australasian Journal of Philosophy*, 61: 4, 343-377.

— 1991 *Parts of Classes*, Oxford: Blackwell.

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Lowe, Ernest Jonathan 2002 "A Defence of the Four-Category Ontology", in: Carlos Ulises Moulines and Karl-Georg Niebergall (eds.), *Argument und Analyse*, Paderborn: Mentis, 225-240.

— 2002a *A Survey of Metaphysics*, Oxford: Oxford University Press.

Maddy, Penelope 1997 *Naturalism in Mathematics*, Oxford: Clarendon Press.

Meixner, Uwe 1992 "On Negative and Disjunctive Properties", in: Kevin Mulligan (ed.), *Language, Truth and Ontology*, Dordrecht: Kluwer, 28-36.

Menzel, Chris 1993 "Singular Propositions and Modal Logic", *Philosophical Topics* 21, 113-148.

Neuhaus, Fabian, Grenon, Pierre, and Smith, Barry 2004 "A Formal Theory of Substances, Qualities, and Universals", in: Achille Varzi and Laure Vieu (eds.), *Formal Ontology and Information Systems. Proceedings of the Third International Conference*, Amsterdam: IOS Press, 49-58.

Newman, Andrew 1992 *The Physical Basis of Predication*, Cambridge: Cambridge University Press.

Oderberg, David forthcoming 2005 "Predicate Logic and Bare Particulars", in: D. S. Oderberg (ed.), *The Old New Logic: Essays on the Philosophy of Fred Sommers*, Cambridge, MA: MIT Press.

Russell, Bertrand 1917 "On Scientific Method in Philosophy", in: B. Russell, *Mysticism and Logic*, London: Routledge and Kegan Paul.

— 1919 *Introduction to Mathematical Philosophy*, London: George Allen and Unwin.

— 1986 *The Philosophy of Logical Atomism and Other Essays 1914-1919. Collected Papers*, Volume 8, London: Allen and Unwin.

Simons, Peter M. 1987 *Parts. An Essay in Ontology*, Oxford: Clarendon Press.

Smith, Barry 2004 "Beyond Concepts, or: Ontology as Reality Representation", in: Achille Varzi and Laure Vieu (eds.), *Formal Ontology and Information Systems. Proceedings of the Third International Conference*, Amsterdam: IOS Press, 73-84.

— *et al. forthcoming* 2005 "Relations in Biological Ontologies", *Genome Biology*.

Sommers, Fred 1982 *The Logic of Natural Language*, Oxford: Clarendon Press.

Wiggins, David 1984 "The Sense and Reference of Predicates: A Running Repair to Frege's Doctrine and a Plea for the Copula", *Philosophical Quarterly* 34, 311-328; repr. in Crispin Wright (ed.), *Frege: Tradition and Influence*, Oxford: Blackwell, 1994.

Wittgenstein, Ludwig 1921 *Tractatus Logico-Philosophicus*, translated by David F. Pears and Brian F. McGuinness, London: Routledge, 1961 (originally published in *Annalen der Naturphilosophie* 14, 185-262).