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Kit Fine: annotated bibliography. Papers 1982-1998

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Papers 1982-1998

- Fine, Kit. 1982. "The Problem of Non-Existents. I: Internalism." *Topoi* no. 1:97-140.

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"The main philosophical question about non-existents is whether there really are any. My own view is that there are none. But even if this is granted, we may still ask what they are like, just as the materialist may consider the nature of sensations or the nominalist the nature of numbers.

On this further topic, there seem to be three main divisions of thought, which may be respectively labelled as:

- (i) platonism / empiricism;
- (ii) literalism / contextualism;
- (iii) internalism / externalism.

Let me attempt a rough characterization of these divisions. More refined formulations will come later. On a platonic conception, the non-existent objects of fiction, perception, belief and the like do not depend for their being upon human activity or upon any empirical conditions at all; they exist, or have being, necessarily.

Under an empirical conception, on the other hand, these objects are firmly rooted in empirical reality; they exist, or have being, contingently. On an extreme conception of this sort, these objects are literally created and are brought into being by the appropriate activity either of or within the agent.

(...)

All in all, the three divisions provide for $8 (= 2^3)$ combinations of positions. Each, I think, is coherent, but some are more natural than others. For example it is natural, though not necessary, for the 'platonist' to accept internalism and for the 'empiricist' to accept externalism; for the means by which the objects are individuated will naturally be taken to provide conditions for their existence or being.

My own view on these questions is given by empiricism, contextualism and externalism, not that this is a common combination in the literature. This view will be defended in the second part of this paper. In the present part, I am concerned to discuss a view that combines internalism with contextualism and platonism; and in the third part, I shall discuss the literalist position, mainly in association with platonism and internalism. I have not attempted systematically to consider all of the possible combinations of position. I have only looked at the more prominent or plausible of the views, though what I say on them should throw light on what is to be said of the others.

The plan of the present part is as follows. In section A2, I discuss general methodological issues facing any philosophical study of nonexistents and, in particular, defend the claim that one can say what they are like without presupposing that there really are any. In section B, I try first to delineate more precisely the subjectmatter of our theories and then to describe the problems of providing identity and existence conditions with which any such theory should deal. In section C, I give an initial formulation of an internalist theory, which is successively refined in section D. Finally, in section E, I give two major criticisms of the theory as thus developed. A more detailed account of each section is given in the list of contents.

It is of the greatest importance to note that the present part does not contain my own views on the subject. It is only in the last section of this part that the internalist position is criticized, and it is only in the second part of this paper that my own, more positive, views are developed." (pp. 97-99)

2. ———. 1982. "First-Order Modal Theories. III: Facts." *Synthese* no. 53:43-122. "This paper forms the third part of a series on the development and study of first-order modal theories. It was not originally intended for this issue, but is relevant to Prior's work in two main ways. First, it does not treat modal logic as a mere technical exercise, but attempts to relate it to common philosophical concerns. This was an approach that Prior himself adopted and perhaps did more than anyone else to foster. Secondly, the paper deals with the more specific topic of facts. This was a matter upon which Prior had definite views and upon which he had written extensively - in relation to the definition of necessity ([25]), the semantics for the modal system Q ([26]), and the correspondence theory of truth ([27] and [29]). I have found all of these writings useful and, although I have disagreed with him on several points, the influence of his views on my own should be evident. It is therefore with respect and affection that I dedicate this paper to his memory. The paper falls into two main parts, one philosophical and the other technical. Either may be read independently of the other, but both are required for an all-round

view. The first part is in two sections. One attempts to show that a modal first-order theory of facts is viable, and the other discusses its principles and their bearing on various philosophical issues. The second part is in six sections, which fall into three groups. Those of the first group (§§3--4) deal with the modal theory of possible worlds, both in itself and in its application to other subject-matter. Since I regard worlds as very big facts, it is only natural that they should be considered in this paper. The next section (§5) deals with the theory of facts under the anti-objectualist assumption that they contain no individual constituents. The sections of the last group (§§6-8) deal with facts under objectualist assumptions and include a statement of the appropriate objectualist conditions, a proof of their equivalence to the corresponding conditions for propositions, and an account of the resulting theories. It will be helpful, and sometimes essential, to have the earlier parts of the series ([15] and [16]) at hand.

In the technical part of this paper, I have concentrated on the question of finding a correct essentialist theory of facts. As far as I know, very little work has been done in this direction, although there is a start in [46]. On the other hand, there is now a fair amount of material on facts as a subject, not of object-theory, but of semantical metatheory (see [45], [21] and [43], for example). I do not wish to dispute the interest of this material, either for logic or the philosophy of language; but it will not fall within the purview of the paper." (pp. 43-44)

References

[15] Fine, K. (1979): 'First-Order Modal Theories II - Propositions', *Studia Logica* 39, 159-202.

[16] Fine, K. (1981): 'First-Order Modal Theories I - Sets', *Nous* 15, 117-206.

[21] Martin J. (1975): 'Facts and the Semantics of Gerunds', *Journal of Philosophical Logic* 4, 439-454.

[25] Prior, A. N. (1948): 'Facts, Propositions and Entailment', *Mind* 57, 62-68.

[26] Prior, A. N. (1957): *Time and Modality*, Oxford: Clarendon Press.

[27] Prior, A. N. (1967): 'Correspondence Theory of Truth', in *Encyclopedia of Philosophy* (ed. P. Edwards), New York: Macmillan.

[29] Prior, A. N. (1971): *Objects of Thought*, England: Oxford University Press.

[43] Taylor, B. (1976): 'States of Affairs' in *Truth and Meaning* (ed. G. Evans and J. McDowell), Oxford: Clarendon Press.

[45] van Fraassen, B. C. (1969): 'Facts and Tautological Entailments', *The Journal of Philosophy* 66, 477-487.

[46] Wells, R. S. (1949): 'The Existence of Facts', *Review of Metaphysics* 3, 1-20.

3. ———. 1982. "Act, Events and Things." In *Sprache und Ontologie. Akten des sechsten Internationalen Wittgenstein-Symposiums, 23. bis 30. August 1981, Kirchberg am Wechsel (Osterreich)*, edited by Leinfellner, Werner, Kraemer, Eric and Schank, Jeffrey, 97-105. Wien: Holder-Pichler-Tempsky.

"The purpose of my theory is not to provide a reference for ordinary uses of a *qua*-phrase but to account for the identity of certain other objects — chairs, tables and the like — to which we clearly do refer.

Qua objects are governed by certain principles; and it is in terms of them that they are best understood.

Existence. The *qua* object X *qua* ϕ exists at a given time (world-time) if and only if x exists and has ϕ at the given time (world-time);

Identity. (i) Two *qua* objects are the same only if their bases and glosses are the same, (ii) A *qua* object is distinct from its basis (or from the basis of its basis, should that be a *qua* object, and so on).

Inheritance. At any time (world-time) at which a *qua* object exists, it has those normal properties possessed by its basis." (p. 100)

(...)

"The theory of *qua*- objects has some other applications worth mentioning. First, the *qua* objects are very like Aristotle's compounds of matter and form, with the matter corresponding to the basis and the form to the gloss. Aristotle's views, it seems to me, have not been taken seriously enough; many of his more distinctive doctrines

- have either been forgotten or fallen into disrepute. A modern version of the Aristotelian theory should give us the courage to embrace some of those doctrines and the means to articulate them more clearly.
Secondly, the theory of qua objects is able to throw light on the question of the ground ' for necessary truths." (p. 104)
4. ———. 1983. "The Permutation Principle in Quantificational Logic." *Journal of Philosophical Logic* no. 12:33-37.
"The story goes back to 1940, with the publication of Quine's *Mathematical Logic* [5]. He there presents a system of quantificational logic in which only sentences or closed formulas are theorems."
(...)
"The story now goes to 1963, with the publication of papers by Kripke [2] and Lambert [3]. Kripke was concerned to block the derivation of the Barcan formula or its converse within a quantified version of the modal logic S5. He was able to do this by requiring, as in Quine [6], that only closed formulas be theorems. However, because he wished to dispense with the rule of necessitation and because he also wished to allow for the empty domain, he did not quite take Quine's revised system as the quantificational basis for his modal logic."
(...)
Quite independently, Lambert developed a similar system. Like Kripke, he was concerned to allow for the empty domain; but he also wished to allow for theorems with free variables."
(...)
"As later became clear, Lambert's full system (with identity) is complete for its intended interpretation. But it was then generally assumed that this system without its identity axioms and the corresponding quantificational part of Kripke's system (which had not been formulated with identity in the first place) were also complete. Indeed, in their paper [4] of 1970, Leblanc and Meyer gave a metalogical investigation of the Lambert fragment in which it was presupposed that Permutation and related principles were derivable; and, in [2], Kripke claimed completeness for his full modal system, which would have entailed completeness for its quantificational fragment. But then, Lambert pointed out, in a letter to Meyer of around 1968-9, the difficulty of deriving Permutation within the identity-free part of his system; and independently, in his paper of 1970 ([7], p. 286, fn. 6), Trew pointed to the related difficulty of deriving Permutation within Kripke's system. The problem of deriving the principle became open and, at least within the world of free logicians, achieved some notoriety.
It now appears that Permutation is not derivable within these systems." (pp. 33-35)
- References
- [1] Berry, G. D. W., 'On Quine's axioms of quantification', *Journal of Symbolic Logic* 6 (1941), 23-27.
[2] Kripke, S., 'Semantical considerations on modal logic', *Acta Philosophica Fennica* 16 (1963), 83-94.
[3] Lambert, K., 'Existential import revisited', *Notre Dame Journal of Formal Logic* 4 (1963), 288-292.
[4] Leblanc, H. and Meyer, R. K., 'On prefacing $(\forall X) A \supset X AY/X$ with $(\forall Y) - A$ free quantification theory without identity', *Zeitschrift für Mathematische Logik und Grundlagen der Mathematik* 16 (1970), 447-462.
[5] Quine, W. V., *Mathematical Logic* (1st edn.), Harvard University Press, Boston, 1940.
[6] Quine, W. V., 2nd edn. of above (1951).
[7] Trew, A., 'Nonstandard theories of quantification and identity', *Journal of Symbolic Logic* 35 (1970), 267-294
5. ———. 1983. "A Defence of Arbitrary Objects." *Proceedings of the Aristotelian Society* no. Supplementary volume 57:55-77.
Reprinted in: Fred Landman, Frank Veltman (eds.), *Varieties of Formal Semantics. Proceedings of the Fourth Amsterdam Colloquium, September 1982*, Dordrecht:

Foris Publications, 1984, pp. 123-142.

"There is the following view. In addition to individual objects, there are arbitrary objects: in addition to individual numbers, arbitrary numbers; in addition to individual men, arbitrary men. With each arbitrary object is associated an appropriate range of individual objects, its values: with each arbitrary number, the range of individual numbers; with each arbitrary man, the range of individual men. An arbitrary object has those properties common to the individual objects in its range. So an arbitrary number is odd or even, an arbitrary man is mortal, since each individual number is odd or even, each individual man is mortal. On the other hand, an arbitrary number fails to be prime, an arbitrary man fails to be a philosopher, since some individual number is not prime, some individual man is not a philosopher.

Such a view used to be quite common, but has now fallen into complete disrepute. As with so many things, Frege led the way." (p. 55)

(...)

"In the face of such united opposition, it might appear rash to defend any form of the theory of arbitrary objects. But that is precisely what I intend to do. Indeed, I would want to claim, not only that a form of the theory is defensible, but also that it is extremely valuable. In application to a wide variety of topics— the logic of generality, the use of variables in mathematics, the role of pronouns in natural language— the theory provides explanations that are as good as those of standard quantification theory, and sometimes better.

Rather than present the finished theory at the outset, we may see it as the outgrowth of the criticisms that have been directed against its cruder formulations. Each criticism, if not deflected, will lead to an appropriate change of formulation. The finished form of the theory will then emerge as the cumulative result of these various criticisms; it will be, if you like, the prize that the proponent of the naive view can carry off with him in the contest with his critics. This is not how I myself came to the theory; but it is perhaps the most congenial approach for those who are already sceptical. (pp. 55-56)

6. ———. 1984. "Critical Review of Parsons' '*Nonexistent Objects* '." *Philosophical Studies* no. 45:95-142.

Review of: Terence Parsons, *Nonexistent Objects*, New Haven: Yale University Press, 1980.

"There has recently been a rebellion within the ranks of analytic philosophy. It has come to be appreciated that, in the debate between Russell and Meinong, Russell was perhaps mistaken in his criticisms and Meinong was perhaps correct in his views. As a consequence, an attempt was made to rehabilitate the Meinongian position, to defend it against the most obvious attacks and to develop it in the most plausible ways. T. Parsons was among the first of the contemporary philosophers to make this attempt, (1) and so it is especially appropriate that his views should now be set out in a book.

I should say, at the outset, that I thoroughly approve of the Meinongian project. As Parsons makes clear (pp. 32— 38), we refer to non-existents in much the same way as we refer to other objects. It is therefore incumbent upon the philosopher to work out the principles by which our discourse concerning such objects is governed. Not that this is necessarily to endorse a realist position towards the objects of the resulting theory. Nominalists and Platonists alike may attempt to set out the principles that govern arithmetical discourse; and it is in the same spirit that the realist or anti-realist may attempt to set out the principles of our fictional discourse. Despite my approval of the project, I must admit to some misgivings as to how Parsons has carried it out. These misgivings are of two kinds. There are first some internal criticisms, requiring only change within Parsons' basic approach. There are then some external criticisms, requiring change to the basic approach.

These criticisms, though, should not be thought to detract from the merits of Parsons' book. It is, in many ways, an admirable contribution to the field.

It gives weight both to the interest and the legitimacy of the Meinongian enterprise; it pinpoints the difficulties which any satisfactory theory must deal with; and in its solution to those difficulties, it sets up a theory with a degree of rigour and systematicity that should serve as a model for years to come. As a well worked-out and accessible contribution to object theory, there is no better book." (pp. 95-96)

(1) Others include Castañeda [1], Rapaport [7], Routley [8] and Zalta [9].

References

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[7] Rapaport, W.: 1978, 'Meinongian theories and a Russellian paradox', *Nous* 12, pp.153-180.

[8] Routley, R.: 1980, *Exploring Meinong's Jungle and Beyond* (Australian National University, Canberra).

[9] Zalta, E. N.: 1980, 'An introduction to a theory of abstract objects', Ph.D. Thesis (University of Massachusetts, Amherst)

7. Fine, Kit, and Mc Carthy, Timothy. 1984. "Truth without Satisfaction." *Journal of Philosophical Logic* no. 13:397-421.

"In his famous paper [7], Tarski gave a definition of truth for a formalized language. Unable to perform a direct recursion on the concept itself, he gave a definition in terms of satisfaction. This makes it natural to ask if such an indirect procedure is necessary or whether a definition of truth can be given without using or somehow invoking the concept of satisfaction.

The question, as it stands, is vague; and later we shall be concerned to make it more precise. But even as it stands, it has an obvious technical interest. The situation that Tarski found himself in is common in mathematics. We wish to define a certain concept, but unable to perform a direct recursion on the concept itself we perform a recursion on a related concept of which the given concept is a special case. It would therefore be desirable to know when the related concept is necessary, both in the case of truth and in general.

The question may also have some philosophical interest. There is a fundamental difference between the concepts of truth and of satisfaction. The former merely applies to certain linguistic units; the latter connects language to an ontology of objects, typically extra-linguistic. A negative result on defining truth without satisfaction may perhaps constrain formal attempts to implement non-referential conceptions of truth. In the present paper, however, we will not be concerned in detail with the philosophical aspects of our question, although we will from time to time mention some points of contact between our discussion and the philosophical literature.

Interest in our question dates back to Wallace [9]; and the topic was subsequently taken up by Tharp [8] and Kripke [3] (especially Section 10).

We have made our presentation self-contained, though the reader may consult the earlier work for general background and for elucidation of particular points.

The plan of our paper is as follows. Section 1 sets out the general framework in which our question and its cognates are posed. Section 2 solves the questions in case the meta-theory is not required to be finitely axiomatized; and Section 3 gives partial solutions in case finite axiomatizability is required, thereby answering a question of Kripke's [3] and of Tharp's [8].

Finally, Section 4 considers the question under other provisos on the metatheory." (pp. 397-398)

References

[3] Kripke, Saul, 'Is there a problem about substitutional quantification?' in G. Evans and J. McDowell (eds.), *Truth and Meaning: Essays in Semantics* (Oxford, 1976), 325-419.

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[8] Tharp, Leslie H., 'Truth, quantification, and abstract objects', *Nous* V (1971), 363-372.

- [9] Wallace, J., 'On the frame of reference', in D. Davidson and G. Harman (eds.), *Semantics of Natural Language*, D. Reidel, 1972, pp. 219-252.
8. Fine, Kit. 1985. "Natural Deduction and Arbitrary Objects." *Journal of Philosophical Logic* no. 14:57-107.
Reprinted in *Philosopher's Annual*, vol. 8, 1985.
"This paper is an abridged and simplified version of my monograph *Reasoning with Arbitrary Objects* [4]. It may be read by the diligent as a preparation for the longer work or by the indolent as a substitute for it. But the reader, in either case, may find it helpful to consult the paper, *A Defence of Arbitrary Objects* [3], for general philosophical orientation.
This paper deals with certain problems in understanding natural deduction and ordinary reasoning. As is well known, there exist in ordinary reasoning certain procedures for arguing to a universal conclusion and from an existential premiss. We may establish that all objects have a given property by showing that an arbitrary object has the property; and having shown that there exists an object with a given property, we feel entitled to give it a name and infer that it has the property." (p. 57).
References
[3] Fine, K., 'A defence of arbitrary objects', *Proceedings of the Aristotelian Society*, supp. vol. LVII, 55-77 (1983); also to appear in *Varieties of Formal Semantics* (eds. F. Landman and F. Veltman), GRASS III, Fovis Publications, Dordrecht Cinnaminson (1984).
[4] Fine, K., *Reasoning with Arbitrary Objects*, to appear in the *Aristotelian Society Monograph Series* (1984).
9. ———. 1985. "Logics Containing K4. Part II." *Journal of Symbolic Logic* no. 50:619-651.
"The plan of this part is as follows. §1 presents some elementary results on pmorphisms. §2 introduces the logics to be proved complete and §3 the conditions for which they are complete. §4 contains the completeness proof. In §5 we show that there are a continuum of subframe logics, while in §6 we give various alternative characterizations of the subframe logics and extend our results on the finite model property from logics to theories. The final section, §7, gives a general characterization of those of the subframe logics that are compact and gives reasonably practicable methods for determining when a logic is compact and what condition its axioms express.
I make free use of the material in the first five sections of Part I, and the reader is advised to have that part at hand." (p. 620)
10. ———. 1985. "Plantinga on the Reduction of Possibilist Discourse." In *Alvin Plantinga*, edited by Tomberlin, James and Inwagen, Peter van, 145-186. Dordrecht: Reidel.
Reprinted in: *Modality and Tense. Philosophical Papers*, as chapter 5, pp. 176-213.
"Plantinga is what I call a modal actualist. He believes that the idioms of necessity and possibility are to be taken as primitive in preference to talk of possible worlds and that only actuals, as opposed to possibles, are to be granted ontological status. On these two issues, he and I agree.
The modal actualist faces a challenge. Talk of possible worlds and of possible individuals appears to make perfectly good sense. There seems to be a clear meaning, for example, in the claim that some possible object does not exist. So the modal actualist, once he grants that possibilist discourse makes sense, must somehow give it sense. It is on this question of how such a challenge is to be met that Plantinga and I disagree.
He favours a reduction of possibilist discourse in which possible worlds and possible individuals give way to propositions and properties, respectively; I favour a reduction in which reference to possibles becomes a modal manner of reference to actuals. In this paper, I shall attempt to adjudicate between these rival positions. In the first section, I shall set out the problem of reduction and Plantinga's favoured solution. In the second, I shall present my central criticism of the reduction, viz. that

it is question-begging. In the next three sections, I shall consider the related question of whether properties and propositions exist necessarily, first presenting an argument against and then disposing of an argument for their necessary existence. In the final section, I shall present my own reduction and the reasons for preferring it to Plantinga's.

The central theme of this paper is the question of reduction; but it should have a broader significance than such a theme might suggest. Partly this is because other issues, of independent interest, are raised: the connection between existence and predication; the necessary existence of propositions; the Priorian stand on modality. But perhaps more important than this question of particular issues is the question of how the issues are to be approached, of what is to count as a plausible consideration one way or another. Even when I have found myself in agreement with Plantinga on a certain view, I have often also found myself unhappy with the reasons he adduces in its favour. It is in this difference of approach, then, that the paper may also have a broader significance." (pp. 145-146)

11. ———. 1988. "Semantics for Quantified Relevance Logic." *Journal of Philosophical Logic* no. 17:27-59.
Reprinted in: Alan Ross Anderson, Nuel D. Belnap, Jr., with contributions by J. Michael Dunn ... [et al.], *Entailment: The Logic of Relevance and Necessity*, Princeton: Princeton University Press, 1992 vol. II, pp. 235-262.
"This paper is a companion piece to my *Incompleteness for Quantified Relevance Logics*. In that earlier paper, I showed that RQ and other systems of quantified relevance logic were not complete for the standard semantics. In the present paper, I provide a semantics with respect to which they are complete." (p. 27)
(...)
"This section is divided into five subsections. The first two lay out the semantics, the third presents the logics, and the last two establish soundness and completeness. A basic knowledge of the semantics for propositional relevance logic is presupposed (see §51). It is conceivable that the methods of the present section might be used to simplify the proofs of incompleteness for the standard semantics; but this is not here investigated." (p. 239 of the reprint)
12. ———. 1989. "Incompleteness for Quantified Relevance Logics." In *Directions in Relevant Logic*, edited by Norman, Jean and Sylvan, Richard, 205-225. Dordrecht: Kluwer.
Reprinted in: Alan Ross Anderson, Nuel D. Belnap, Jr., with contributions by J. Michael Dunn ... [et al.], *Entailment: The Logic of Relevance and Necessity*, Princeton: Princeton University Press, 1992 vol. II, pp. 235-261.
"In the early seventies, several logicians developed a semantics for propositional systems of relevance logic.
(...)
In the light of this work, it seemed reasonable to extend the completeness results to quantificational systems of relevance logic. But what systems should be chosen? One would like, in the first place, to deal with the systems that already exist in the literature, such as quantified R (RQ) or quantified E (EQ). This, at least, is a debt that we owe to the history of the subject. But one would also like to prove completeness for the quantificational analogues of propositional systems that have already been proved to be complete. These analogues might be obtained from the propositional system by adding a standard quantificational component, consisting of such and such axioms and rules. Such a component might be chosen in terms of its intrinsic plausibility as a quantificational basis. Less arbitrarily, it might be chosen so as to yield a complete system when combined with the minimal propositional system (the one complete under no special conditions on o, R or *). Not surprisingly, the pre-existing systems turn out to be equivalent to the systems obtained by the other approach.
The construction of the quantificational analogue is not, in fact, as straightforward as this description might suggest; for the extension of the propositional semantics to the quantificational case is not unique. It must be decided whether the domain I of

- individuals is to be constant or not. If it is not constant, then there are various ways of dealing with nonexistent individuals, individuals that do not belong to the domain of the world or point under consideration. But once these decisions are made, the choice of the quantificational component can be fixed." (p. 205)
13. ———. 1989. "The Problem of *De Re* Modality." In *Themes from Kaplan*, edited by Almog, Joseph, Perry, John and Wettstein, Howard, 197-272. New York: Oxford University Press.
Reprinted in: *Modality and Tense. Philosophical Papers*, as chapter 2, pp. 40-104.
"I want now to evaluate Quine's objections to quantified modal logic, dealing first with the metaphysical and then with the logical argument.
I observed before that the metaphysical argument was operator-specific; for different operators it yields different problems. This observation applies as much to different notions of necessity as it does to notions other than necessity. There is not a single problem of essentialism, but a range of problems, that vary according to the notion of necessity in question.
There are perhaps four principal notions of necessity for which the problem arises; these are, respectively, the logical, the analytic, the metaphysical, and the natural. Of these, the most important is undoubtedly the problem for the metaphysical notion. Indeed, not only is this problem of great importance in itself, but it is central, in my opinion, to any attempt to understand the nature of metaphysics. However, it is not my intention to discuss this problem here. I wish to follow Quine and concentrate my attention on the logical and semantic modalities." (p. 202)
14. ———. 1989. "The Justification of Negation as Failure." In *Logic, Methodology and Philosophy of Science VIII. Proceedings of the Eighth International Congress of Logic, Methodology and Philosophy of Science, Moscow, 1987*, edited by Fenstad, Jens Erik, Frolov, Ivan and Hilpinen, Risto, 263-301. Amsterdam: North-Holland.
"Prolog is a logic programming language; it is used to answer queries on the basis of information provided by the programmer. For the most part, the logic employed by Prolog is standard. But it uses a highly unorthodox rule for establishing negative facts. This rule, the so-called rule of negation as failure, allows us to deny a statement on the grounds that a certain attempt to prove it has failed.
The rule is not classically valid; and therefore the question arises as to how it is to be justified. There are basically three different kinds of justification that have been proposed in the literature. The first is to re-interpret negation to mean something like unprovability. The second is to assume that the program is complete with respect to truths; all truths are derivable. The third is to suppose that the program is complete with respect to conditions; all sufficient conditions for the application of the predicates have been specified.
My aim in this paper is to evaluate these various proposals and then to make a proposal of my own. I shall argue that the existing proposals all suffer from some defect or another: the first is unable to account for a classical reading of negation; the second delivers too much on programs which employ negation; and the third delivers too little on programs which make no use of negation.
I shall then argue that my own proposal is able to avoid these difficulties. From one point of view, the proposal is not new; it is merely a form of the second proposal stated above, according to which all truths are derivable. However, the concept of derivability which is appealed to is quite novel; for the assumption that all truths are derivable, may itself be used in establishing that a given statement is derivable. The assumption has, in other words, a self-referential character.
The proposal has various other features of interest. It provides a natural way of interpreting inductive definitions in which the positive instances of a predicate are allowed to depend upon its negative instances. It sanctions an extension of the rule of negation of failure, under which not only the finite, but also the transfinite, failure of a statement may constitute a ground for its denial. It is capable of variation in the choice of which other assumptions or rules are used in defining the concept of derivability.

(...)

One feature of my exposition is worthy of special note. I have for the most part confined my attention to the sentential case, under which only truth-functional complexity is ever exposed. Such a case is usually regarded as trivial, since most of the interesting features of Prolog depend upon the use of variables. However, in this regard, the rule of negation as failure is an exception. Most of the problems in justifying the rule already arise at the sentential level; and to solve these problems at this level is to have gone a long way towards solving them altogether. There are, however, certain difficulties which are peculiar to the introduction of variables and terms; and these are considered at the end of the paper. It is argued, in particular, that the usual assumptions concerning an ontology of terms are needlessly strong and that an ordinary ontology of individuals can be countenanced in its place." (pp. 263-264)

15. ———. 1990. "Quine on Quantifying In." In *Propositional Attitudes: The Role of Content in Logic, Language and Mind*, edited by Anderson, Anthony and Owens, Joseph, 1-26. Stanford: Center for the Study of Language and Information, Stanford University.
Reprinted in: *Modality and Tense. Philosophical Papers*, as chapter 3, pp. 105-130. "It is my aim in this chapter to evaluate Quine's argument against quantifying into modal contexts, dealing first with the peculiarly modal considerations and then with the more general logical considerations." (p. 2)
16. ———. 1991. "The Study of Ontology." *Noûs* no. 25:263-294.
"A constructional ontology is one which serves to construct complexes from simples. The present paper is concerned with the nature and with the study of such ontologies. It attempts to say, in the first place, how they are constituted and by what principles they are governed. But it also attempts to say how their study may lead one to adopt certain positions and to make certain definitions.
The remarks on the study of ontology are meant to relate to the study of disciplines in general. I am interested in how the study of a discipline gets shaped by the positions which are adopted and the strategies which are pursued. These interact; for the pursuit of certain kinds of strategy will lead to the adoption of certain kinds of position, and the adoption of certain kinds of position will be required by the pursuit of certain kinds of strategy. One therefore needs to understand how they interact.
Certain subsidiary themes run through the paper, all interrelated in one way or another. One concerns a dialectical conception of modality, one that is determined by what is left open at a given stage of enquiry. Another involves a particular way of expressing modal claims, in terms of certain objects requiring others. Yet a third is an interest in a relativist conception of ontology, according to which no ontology stands out as being correct.
The paper concludes with a formal appendix, which attempts to make precise much of what can be made precise in the earlier informal part of the paper. Each part has been designed to be read independently of the other, although a proper understanding of either part depends upon reading them both." (p. 263)
17. ———. 1991. "The Identity of Material Objects." In *Topics in Philosophy and Artificial Intelligence*, edited by Albertazzi, Liliana and Poli, Roberto, 33-37. Bozen: Istituto Mitteleuropeo di Cultura.
Papers from the International Summer Schools in Bozen - 1989-1990.
"1. The Problem of Identity
What is a question of identity? Two responses to this meta-question of identity may be distinguished, which I call the *comparative* and the *intrinsic*. On the comparative conception, one answers a question of identity by saying when two objects of a given sort are the same. On the intrinsic conception, one answers a question of identity by saying what objects of a given sort are "in themselves".
The comparative conception goes back to Locke's famous chapter on identity. It was extended by Frege. Very roughly, we may say that Frege extended the

application of the comparative conception from the identity of concrete objects to the identity of abstract objects. This conception is the dominant one of today; it informs the work of Strawson, Quine, Wiggins and of others.

The basic idea behind the comparative conception is to make the *what* of identity a *when*: to ask what an object of a given sort is is to ask when objects of that sort are the same. But to ask when two objects are the same invites the trivial answer: when they are the same. We need somehow to distinguish the intended answers to this question.

This can often be done by means of the concept of a *presentation*. I mean to use this term in a suitably abstract sense. Thus a sentence might be regarded as a presentation of a proposition; there is no need for a presentation to be something mental or even for it to be that by which we grasp the object.

An intended answer to an identity question then says when two presentations are presentations of the same object; and it says this in terms which do not presuppose the identity of the objects at issue.

Different questions of identity - e.g. at a time, across time, across worlds - turn on different accounts of how the objects are to be presented.

There is a fundamental criticism to be made of the comparative conception. For it says what kind of "career" the object has, not what kind of object it is that has the career. For example, a transtemporal criterion of identity for material things is compatible with a material thing being (a) a primitive substance, (b) a mereological sum of time-slices, (c) the embodiment of a form, (d) an event, and so on. Similarly, the extensional criterion of identity for sets is compatible with a set being (a) constructive, (b) "exclusive", i.e. determined by its non-members rather than by its members, (c) logical, i.e. determined by a property with the required extension rather than by its members.

What is missing from the comparative conception? I would like to suggest that often what is missing is an account of how the objects of the given kind are generated or analysed. Thus primitive substances are not generated from anything else at all, mereological sums are generated by aggregation, embodiments are generated by a suitable embodiment operator, and so on. In each case, we need to say how (if at all) the object is to be analysed; we need to say what the object is in itself." pp. 33-34.

18. ———. 1992. "Aristotle on Matter." *Mind* no. 101:35-57.

"It is my belief that there is still a great deal to be learnt from Aristotle's views on the nature of substance; and it is my aim in a series of papers, of which this is the first, to make clear what these views are and what it is in them that is of value. (1) A peculiarity of my approach, compared to current scholarly practice, is the attempt at rigour. I have tried to provide what is in effect a formalization of Aristotle's views. I have, that is to say, attempted to make clear which of his concepts are undefined and which of his claims underived; and I have attempted to show how the remaining concepts are to be defined and the remaining claims to be derived.

I can well understand a traditional scholar being suspicious of such an approach on the grounds that the various parts of Aristotle's thought are either too unclear to be capable of formalization or else are clear enough not to require it.

Since the matter is not one for a priori dispute, I can only ask the scholar to put his suspicions at bay until the details of the case are examined. I then think that it will be found that the attempt at rigour provides a most valuable guide for the study of the text.

I have not tried to deal with all aspects of Aristotle's thought on substance. I have concentrated on those which centre on the concepts of matter, form, part, and change; and I have neglected those which concern the related concepts of predication, function, priority and power. It is to be hoped that the investigation will be rounded out at some later time to include all of the central aspects of his work. It should also be mentioned that my treatment of the text has not been altogether scholarly. Partly this has been a matter of competence, and partly of inclination. I have been more concerned with the broad sweep of Aristotle's views than with

exegetical detail; and this has led me to conjecture that he held a certain opinion, not because of direct textual evidence but because it is what his view most naturally requires. Thus the Aristotle I have presented here is much more consistent, definite and complete than the Aristotle of the texts." (p. 35)

(1) This paper is based upon the first two sections of my unpublished paper "Aristotle on Substance". I should like to thank the members of a seminar I held at UCLA in the winter of 1991, and Frank Lewis in particular, for many helpful discussions on some of the topics of the paper. I am also grateful to Richard Sorabji for valuable remarks on an earlier version of the paper.

19. ———. 1992. "Transparent Grammars." In *Logic from Computer Science. Proceedings of a Workshop held November 13-17, 1989*, edited by Moschovachis, Yiannis N., 129-151. New York: Springer.

"1. Introduction

'Cat' is a word which occurs in 'cattle', but it does not occur as a word; '1-1-2' is a term which occurs in '1+ 2.3', but it does not occur as a term. All such occurrences of expressions might be said to be accidental, since they are accidents of how the syntax of the language happens to be realized.

The notion of accidental occurrence is significant in various areas of thought. In logic, it greatly aids the formulation and proof of meta-logical results if it can be assumed that the underlying language contains no accidental occurrences. For example, a subformula can then simply be defined as a formula which occurs within a given formula rather than as an expression which is thrown up by a parsing of that formula. In philosophy, the issue of whether one can quantify into modal contexts has been seen to turn on such questions as to whether the occurrence of '9' in 'necessarily, $9 > 7$ ' is accidental or not; and the absence of accidental occurrence has been regarded as a condition on any "ideal language". In computer science and in linguistics, the presence of accidental occurrences has an obvious relevance to parsing, since they lead to the danger that a parser might mistake an apparent constituent of the expression to be parsed for a genuine constituent.

Let us say that a language or grammar is transparent if it permits no accidental occurrences. It is the main purpose of the present paper to investigate the conditions under which a context-free grammar is transparent.

It is shown how any accidental occurrence reduces to a certain "primitive" case; and it is shown how such primitive occurrences might be detected.

On the basis of these results on reduction and detection, an effective test for transparency is then given.

The concept of transparency represents a strengthening of the more familiar concept of nonambiguity. Any transparent grammar, at least of a well-behaved sort, is unambiguous, though not every unambiguous grammar is transparent. Moreover, what is required for many purposes is not merely an unambiguous but a transparent grammar. It is therefore significant in this regard that there is an effective test for the stronger property even though there is no effective test for the weaker one. The plan of the paper is as follows. The first two sections introduce the relevant notions from the theory of context-free grammars. The third section explains the connection between nonambiguity and transparency.

The fourth section establishes the reduction of accidental occurrence to the primitive case. The next three sections deal with the question of detecting the primitive accidental occurrences: a more fully articulated or canonical version of the given grammar is introduced; it is shown how accidental occurrences in the given grammar correspond to certain kinds of expression in the canonical grammar; and a precedence analysis is given of those expressions in the canonical grammar which correspond to the primitive accidental occurrences in the given grammar. An effective test for transparency is then provided in the final section.

The treatment of transparency in this paper has been very brief. Many of the results can be extended; and I have given a much fuller account in Fine [1]." (pp. 129-130)

References

- [1] Fine, K., *Transparency I and II*, submitted to *Language and Control*.
20. ———. 1994. "Essence and Modality." *Philosophical Perspectives* no. 8:1-16. Reprinted in *The Philosopher's Annual for 1994*, volume 16, (edited by Patrick Grim, Gary Mar, Peter Williams), Stanford: CSLI 1996 and in J. Kim, D. Korman, E. Sosa (eds.), *Metaphysics: An Anthology*, Oxford: Wiley-Blackwell 2011 (second edition).
 "The concept of essence has played an important role in the history and development of philosophy; and in no branch of the discipline is its importance more manifest than in metaphysics.
 Its significance for metaphysics is perhaps attributable to two main sources. In the first place, the concept may be used to characterize what the subject, or at least part of it, is about.
 For one of the central concerns of metaphysics is with the identity of things, with what they are.
 But the metaphysician is not interested in every property of the objects under consideration. In asking 'What is a person?', for example, he does not want to be told that every person has a deep desire to be loved, even if this is in fact the case. What then distinguishes the properties of interest to him? What is it about a property which makes it bear, in the metaphysically significant sense of the phrase, on what an object is?
 It is in answer to this question that appeal is naturally made to the concept of essence. For what appears to distinguish the intended properties is that they are essential to their bearers." (p. 1)
 (...)
 "It is my aim in this paper to show that the contemporary assimilation of essence to modality is fundamentally misguided and that, as a consequence, the corresponding conception of metaphysics should be given up. It is not my view that the modal account fails to capture anything which might reasonably be called a concept of essence. My point, rather, is that the notion of essence which is of central importance to the metaphysics of identity is not to be understood in modal terms or even to be regarded as extensionally equivalent to a modal notion. The one notion is, if I am right, a highly refined version of the other; it is like a sieve which performs a similar function but with a much finer mesh.
 I shall also argue that the traditional assimilation of essence to definition is better suited to the task of explaining what essence is. It may not provide us with an analysis of the concept, but it does provide us with a good model of how the concept works. Thus my overall position is the reverse of the usual one. It sees real definition rather than de re modality as central to our understanding of the concept." (p. 3)
21. ———. 1994. "Compounds and Aggregates." *Noûs* no. 28:137-158.
 "Some objects appear to be composed of parts: a quantity of sand of its grains, a throbbing pain of its throbs, a set of its members, and a proposition of its constituents.
 There seem to be two fundamentally different ways in which an object can be composed of parts. One is nonstructural in character; the parts just merge. The other is structural; the parts hang together within a structure. Thus of the examples above, the first two, the sand and the pain, are composed from their parts in a nonstructural fashion, while the last two, the set and the proposition, are composed in a structural manner.
 The notion of a nonstructural method of composition may be taken to be one which conforms to certain structure-obliterating identity conditions. These are as follows: order and repetition among the composing objects is irrelevant to the result; the composition of a single object is the object itself; and the composition of compositions of objects is the composition of those very objects'. Thus the first of these conditions excludes concatenation as a nonstructural method of composition; while each of the remaining conditions excludes the set-builder (the operation which composes a set from its members).

Let us agree to call any nonstructural method of composition a method of fusion. There is a particular such method, I call it aggregation, which has been very prominent in the literature on part-whole. It may be characterized as a method of composition which conforms to the identity conditions above and which also conforms to the following existence conditions: the aggregate of objects which exist in time exists at exactly those times at which one of the objects exists; and an aggregate of objects which are located in space occupies, at any given time at which it exists, exactly those places which are occupied by one of the objects.

It has often been supposed that aggregation is a legitimate method of composition, that objects may be composed from others in conformity with the conditions set forth above. What has made aggregation so attractive, apart from any intuitive appeal it may have, are two main factors (which will be discussed in more detail later in the paper). The first, and most important, is the identification of a thing with the content of its spatio-temporal extension. The second is the identification of a thing with the fusion of its time-slices. Both of these forms of identification require that the objects fuse in the manner of aggregation.

It has also often been supposed that aggregation is the only legitimate method of fusion. Part of the appeal of this further position may arise from a general hostility to different methods of composition, whether they be methods of fusion or not. Under the form of nominalism championed by Goodman, for example, there can be no difference in objects without a difference in their parts; and this implies that the same parts cannot, through different methods of composition, yield different wholes.

However, I suspect that many of those who would be open to structural methods of composition would still not be open to distinct nonstructural methods of composition. For it is hard to see, especially given the identification of a thing with its spatio-temporal content, what other methods of fusion there might be; and it is hard to see how there could be alternative conceptions of a fusion, of a whole at the same level as its elements and formed without regard to their order or repetition. Let us call the extreme position, that there is only one method of composition, mereological monism; let us call the less extreme position, that there is only one method of fusion, fusion monism; and let us call that particular version of fusion monism according to which aggregation is the sole method of fusion aggregation monism.

The main purpose of this paper is to show that the last of these three positions is mistaken. I want to show that there is a method of fusion which is not aggregative, i.e. which does not conform to the characteristic existence conditions for aggregates. However, my attack on this position may be relevant to the two other positions as well. For granted that aggregation is itself a legitimate method of fusion, it follows that fusion monism should be dropped in favour of a pluralist position. And to the extent that the adoption of monism depended upon a general hostility to structural considerations, the way is then open to the admission of structural methods of composition.

It is also my intention to attack two related forms of monistic doctrine. For just as we can single out the aggregative method of nonstructural composition, so we can single out the aggregative way of being a nonstructural part and the aggregative kind of nonstructural whole. One might then maintain that not only does aggregation constitute the only nonstructural method of composition, but that it also constitutes the only nonstructural way of being a part and the only nonstructural way of being a whole. We therefore have three forms of monism, one with respect to composition, another with respect to part, and a third with respect to whole. As will later become clear, the two further forms of monism are successively weaker than the original; and so their denials might be taken, in mimicry of Quine, to comprise three grades of mereological involvement.

From the discussion of monism will emerge objections to two other prominent doctrines: extensionalism and mereological atomism. According to the first of these, things are the same when their extensions (spatial, spatio-temporal, or modal-

spatio-temporal) are the same; and according to the second, parts are prior to their wholes.

For the purposes of attacking the aggregation monist, I have assumed that aggregation is a legitimate method of fusion. Towards the end of the paper, I suggest that there is no such method and propose a form of fusion monism in which some other method of fusion takes the place of aggregation. However, my tentative endorsement of fusion monism is not meant in any way to lend support to a general monist position." (pp. 137-139)

22. ———. 1994. "A Puzzle Concerning Matter and Form." In *Unity, Identity, and Explanation in Aristotle's Metaphysics*, edited by Scaltsas, Theodore, Charles, David and Gill, Mary Louise, 13-40. Oxford: Clarendon Press.
- "Montgomery Furth has written (1), "given a suitable pair of individuals ... there is no reason of Aristotelian metaphysics why the very fire and earth that this noon composes Callias and distinguishes him from Socrates could not, by a set of utterly curious chances, twenty years from now compose Socrates ...". He does not specify what these "curious chances" might be. But we may suppose that Socrates eats Callias for his lunch and that, owing to the superiority of Callias' flesh and bone, it is the matter of this which remains in Socrates after the period of twenty years. That such an exchange of matter is possible is a point on which many Aristotelian scholars could agree. However, I wish to argue that such a case gives rise to a fundamental difficulty; for its possibility runs into conflict with certain basic metaphysical principles which are commonly attributed to him and which would also be commonly accepted.
- The problem consequently arises as to how this difficulty is to be resolved. This problem itself may be regarded in two somewhat different lights. On the one hand, it may be regarded as a difficulty for Aristotle. The question then is whether one can find a solution which would be acceptable to him, either in the sense that he would or that he could accept it. On the other hand, it may be regarded as a difficulty for a neo-Aristotelian, i.e. to someone who is sympathetic to the analysis of things into matter and form. The question then is to find a solution, regardless of whether or not it would be acceptable to Aristotle.
- For the most part, my concern has been with the exegetical question; and even here, my purposes have been somewhat limited. For I have not attempted to settle on one solution as opposed to another. My aim has been to map out the exegetical space rather than to locate the views of Aristotle within it.
- However, it should be mentioned that I count myself a neo-Aristotelian (and, indeed, it was my own commitment to hylomorphism which led me investigate Aristotle' views in the first place). It has therefore been of some importance for me to take the purely metaphysical question into account."(p. 13)
- (1) Furth, M. *Transtemporal Stability in Aristotelian Substances*, *Journal of Philosophy*, 75 (1978), 624-646; reprinted in *Substance, Form, and Psyche: An Aristotelean Metaphysics*, Cambridge University Press: Cambridge, 1988. (note abbreviated).
23. ———. 1995. "The Logic of Essence." *Journal of Philosophical Logic* no. 24:241-273.
- "Central to this paper is a certain distinction. This is the distinction between objects simply having a property and their having that property essentially or by their very nature. Also central to the paper is a certain claim. This is the claim that the notion of essence, of objects essentially having a property, is not to be understood in terms of the notion of necessity.
- The claim is defended in my paper *Essence and Modality*. But the basic idea behind the defence can be given here. Consider Socrates and the singleton set containing him. Now although it is plausible to suppose that the singleton essentially contains the man, it is not plausible to suppose that the man essentially belongs to the singleton. There is nothing in the nature of Socrates which demands that there be any sets, let alone one that contains him. However, the standard accounts of essence in terms of necessity are unable to account for this asymmetry. For under such an

- account, the singleton essentially containing Socrates will consist in something like its being necessarily the case that the set contains Socrates if the set exists. But if this is true, then it will also be necessarily the case that Socrates belongs to the set if the man exists." (p. 241)
24. ———. 1995. "Part-Whole." In *The Cambridge Companion to Husserl*, edited by Smith, Barry and Smith, David Woodruff, 463-485. Cambridge: Cambridge University Press.
- "Husserl's third *Logical Investigation* is perhaps the most significant treatise on the concept of part to be found in the philosophical literature. (1) In it Husserl attempts to analyze the notion of dependent part, to lay down the principles governing its use, and to relate it to more general considerations concerning the nature of necessity and unity.
- He begins his study with the consideration of objects in the psychological sphere. A typical example of the kind of object he has in mind is that of a visual datum, a red patch, let us say, and its various aspects or "moments"- its colour, say, or its extension. He takes each of these moments to be peculiar to the object in question; no other datum, no matter how great its resemblance to the original datum, will have the very same moments. He also takes the moments to be, in a suitably broad sense, part of the given object; they are thought to be actually present in it." (p. 463)
- (...)
- "My aim in the present essay is to clarify certain formal aspects of Husserl's thought. I have here and there, inserted some critical comments; but my main concern has been to say what the views are, and not to say whether or not they are right. Husserl himself took the formalization of his ideas to be not only possible, but highly desirable. He writes (§24, 484):
- a proper working out of the pure theory we here have in mind would have to define all concepts with mathematical exactness and to deduce all theorems by argumenta in forma, i.e., mathematically. . . . That this end can be achieved has been shown by the small beginnings of a purely formal treatment in our present chapter. In any case, the progress from vaguely formed to mathematically exact concepts and theories is here, as everywhere, the precondition for full insight into a priori connections and an inescapable demand of science.
- Thus the present paper can be regarded as an attempt to carry through the project that he began." (p. 464)
25. ———. 1995. "The Problem of Mixture." *Pacific Philosophical Quarterly* no. 76:266-369.
- Reprinted in: Frank A. Lewis and Robert Bolton (eds.), *Form, Matter and Mixture in Aristotle*, Oxford: Blackwell, 1996, pp. 82-182.
- "For Aristotle, the everyday world contains three main kinds of things: the elements, the homogeneous mixtures, and the heterogeneous substances. The topic of mixture was vigorously debated in medieval times (see Maier (1982): 142). But contemporary interest has focused on the objects at the extremes of his ontology -- the elements and the substances -- while the topic of mixture has been relatively neglected. This is unfortunate. For not only is the topic of great interest in its own right, it is also important for a wider understanding of Aristotle's scientific and metaphysical views.
- The intrinsic interest of the topic largely arises from the difficulty in seeing how a non-atomistic conception of matter is to be reconciled with a plausible view of mixture. The exegetical interest has perhaps two main sources. The first resides in the special position occupied by mixtures in Aristotle's ontology. For all substances are composed of mixtures; and all elements compose mixtures, in so far as they compose anything at all. Thus the mixtures provide the cushion, as it were, between the elements and the substances; and any account of the role of the elements or of the nature of the substances should deal with the relationship of each to the mixtures.
- The other source of exegetical interest lies in the relevance of the topic of mixture to other, more general, topics -- principally, potentiality and change. Just as

mixtures occupy a kind of midpoint between the elements and the substances, so mixing occupies a kind of midpoint between accidental and substantial change; and the potentiality of the ingredients in a mixture is one of the more important and problematic forms of potentiality for Aristotle. Thus no exegesis of his views on either change or potentiality can be considered complete unless it takes into account his views on mixture.

We now know that Aristotle's views on mixture are mistaken, and badly mistaken at that. In rejecting atomism he made a critical (though understandable) error; and when one combines the rejection of atomism with the antiquated belief in the four elements, it is easy to conclude that his views are purely of scholarly interest with no real relevance to contemporary concerns. But even though his views may be much further removed from reality than those of modern science, they are much closer in many ways to common sense. In the laboratory we do not suppose that every part of some butter is butter. But in the kitchen we do; and it is convenient, though erroneous, assumptions of this sort that guide us in our everyday life. This therefore suggests that we treat these views of Aristotle as having their most direct bearing, not on the nature of reality, but on the structure of common sense.

There have been recent attempts in cognitive science to formalize the content of folk or naive physics; such a physics is meant to provide the principles that would enable one to construct a robot that could deal with the everyday world in much the same way as we do. If I am not mistaken, the contemporary interest of Aristotle's scientific views may lie as much in their connection with these developments within cognitive science as it does with the content of the established sciences. I might add that the recent attempt to rehabilitate the notion of capacity by Cartwright (1989) and others also gives a topical interest to Aristotle's general views on capacities and on the way they might compose or interact within a mixture.

The paper is in six sections. In the first, I state the problem with which Aristotle opens his discussion of mixture in *Generation and Corruption*: how is mixture possible? Aristotle thinks he has a solution; and our problem is to understand what that solution is. In the next section, I consider three interpretations of his views on mixture, those of Sharvy (1983), Gill (1989) and Bogen (1995), and find all of them wanting. The main defect with these proposals, from my own point of view, is that they do not take Aristotle's hylomorphic outlook sufficiently seriously. In the third section, I provide a sketch of that outlook and set out the two main accounts of mixture that are in conformity with it, Leveling and Ascent; one places mixture at the same level as the elements, the other at a higher level. The next two sections are the heart of the paper and constitute a sustained argument in favor of Leveling. It is shown how two doctrines -- the doctrines of intermediates and of derived parts -- enable Aristotle to avoid the apparently insuperable difficulties that lie in the way of its acceptance. The final section considers the problem of how mixing, as opposed to mixture, is possible and argues that Aristotle is also in a position to solve this problem." (pp. 82-83).

References:

Bogen, 1995 "Fire in the belly: Aristotelian elements, organisms, and chemical compounds", this volume [pp. 183-216]

Gill, M. 1989 *Aristotle on Substance: The Paradox of Unity*, New Jersey: Pennsylvania University Press

Maier, A. 1982 *On the Threshold of Exact Science*, Philadelphia: University of Pennsylvania Press

Sharvy, R. 1983 "Aristotle on Mixtures", *Journal of Philosophy*, 80, 439-457.

26. ———. 1995. "Ontological Dependence." *Proceedings of the Aristotelian Society* no. 95:269-290.

"There appears to be a distinctively ontological sense in which one thing may be said to depend upon another. What the one thing is will depend upon the other thing, upon what it is. It is in this sense that one is tempted to say that a set depends upon its members or that a particularized feature, such as a smile, upon the

particular in which it is found. For what the set is will depend upon its members; and what the feature is will depend upon the particular that instantiates it. (1) Granted that there is an intelligible notion of ontological dependence, it would appear to be of great importance to the study of metaphysics. Metaphysics has two main areas of concern: one is with the nature of things, with *what* they are; and the other is with the existence of things, with *whether* they are. Considerations of dependence are relevant to both. For central to the question of the nature of any item is the determination of what it depends upon; and if something is taken to exist, then so must any thing upon which it depends. Indeed, it has often been maintained that it is only those things which do not depend upon anything else that can properly be said to exist at all." (p. 269)

(...)

"But how is the notion of dependence itself to be understood? The idea of what something is, its *identity* or *being*, is notoriously obscure; and the idea of the being of one thing *depending* upon that of another is doubly obscure. A natural suggestion at this point is to take the being of something simply to be its existence. Thus in saying that a set depends upon its members, or a feature upon its instantiator, we are taking the existence of the one to depend upon that of the other. Call this the *existential* construal of dependence. Another natural suggestion is to take the dependence between the beings of the two items, as opposed to the items themselves, to be modal in character. The being of the one will depend upon that of the other in the sense that it is necessary that if the one item has its 'being' then so does the other. Call this the *modal* construal of dependence." (p. 270)

(1) This paper derives from an earlier paper 'Dependent Objects', that was written in 1982 but remained unpublished. Some of the issues raised are discussed at greater length in Fine [1995b]; and no attempt is here made to settle the methodological, as opposed to the conceptual, issues. I should like to thank Ruth Chang and the members of the Wednesday Group at Oxford for helpful comments.

References

Fine K. [1995b] 'Senses of Essence', to appear in *Festschrift for Ruth Barcan Marcus*.

27. ———. 1995. "Senses of Essence." In *Modality, Morality and Belief. Essays in Honor of Ruth Barcan Marcus*, edited by Sinnott-Armstrong, Walter, 53-73. Cambridge: Cambridge University Press.

"One may distinguish between the essential and accidental properties of an object. A property of an object is essential if it must have the property to be what it is; otherwise the property is accidental.

But what exactly is meant by this account? It has been common to give a further explanation in modal terms. A property is taken to be essential when it is necessary that the object have the property or, alternatively, when it is necessary that it have the property if it exist. For reasons that I have already given in my paper "Essence and Modality," I doubt whether this or any other modal explanation of the notion can succeed. Indeed, I doubt whether there exists any explanation of the notion in fundamentally different terms. But this is not to deny the possibility of further clarification; and it is the aim of the present paper to provide it.

What I shall do is to distinguish some of the closely related ways in which the notion may be understood. This will be important for getting clearer both on which claims can be made with its help and on which concepts can be defined with its help. In particular, we shall see that several different senses of ontological dependence correspond to the different senses of essence. The task is also important for the purpose of developing a logic of essentialist reasoning; for most of the different senses of essence that we distinguish will make a difference to the resulting logic. My main concern in this paper has been with making the distinctions, and not with drawing out their implications; but I hope it is clear from the examples what some of these implications are." (p. 53)

28. Fine, Kit, and Schurz, Gerhard. 1996. "Transfer Theorems for Multimodal Logics." In *Logic and Reality: Essays on the Legacy of Arthur Prior*, edited by Copeland,

Jack, 169-214. Oxford: Oxford University Press.

"Many of the modal logics that have been developed contain two or more modal operators. A notable example is the tense logic of Prior, which contains operators for both the past and the future. A more recent example is the logic of programs, which contains infinitely many operators, one for each program.

A multimodal logic will have various monomodal fragments; and in the simplest case, it will be the join of these fragments -- there will be no interactive axioms.

Our concern in the present chapter is to investigate the question of when certain properties of the monomodal logics transfer to their join. To answer this question, we develop a very general proof method, which allows us to piece together models for different logics. The resulting theorems provide very general answers to our question, which are positive in most cases, but not in all.

Our investigation is a natural continuation of those begun by Prior.

For he was interested both in the development of multimodal logics and in their relationship to monomodal logics. It is therefore, with a keen sense of his own contribution to the subject that we have pursued the present line of research." (p. 169)

[Note:] Some of the initial ideas behind this chapter were contained in a letter from Fine to Schurz in 1990. The subsequent work has been joint, with Fine writing up sections 1 and 6 and Schurz writing up the rest. The result on strong completeness transfer has been obtained independantly by Valentin Goranko and Solomon Passy; the results on transfer of strong and weak completeness, f.m.p., and of decidability (under the assumption of weak completeness) have "been obtained independently by Marcus Kracht and Frank Wolter. Our own proof of decidability transfer is based upon ideas in their proof.

29. ———. 1998. "Cantorian Abstraction: A Reconstruction and Defense." *Journal of Philosophy* no. 95:599-634.

"In what follows I shall concentrate on the views of Cantor, though it should be clear how what I say will can be modified to apply to the views of Dedekind. I have not attempted to capture all of the nuances or tensions in Cantor's thought but merely to develop what I take to be its spirit, or central idea. And in developing this idea, I have been guided more by what the idea itself requires than by Cantor's own writings.

The plan of the paper is as follows. I begin by setting out what appear to be decisive objections to the Cantorian account. I then show how these objections can be overcome by making use of the theory of arbitrary objects developed in my book ' *Reasoning with Arbitrary Objects* ' [Chapter VII. The relevant parts of the theory are outlined in section 2; and the application to Cantor's account of number is made in section 3. I show, in section 4, how the approach may be extended to order types and to structure types in general. In the final two sections, I first compare the Cantorian approach to abstraction with the standard approaches of von Neumann and Zermelo, on the one side, and of Russell and Frege, on the other; and I then consider to what extent the Cantorian approach is capable of yielding a structuralist conception of number and order type. In a formal appendix, I briefly indicate how the present theory might be formalized within an extension of ZF [Zermelo-Frankel]." (p. 603)

30. ———. 1998. "The Limits of Abstraction." In *The Philosophy of Mathematics Today* , edited by Schirn, Matthias, 503-630. Oxford: Oxford University Press. Reprinted in expanded form as *The Limits of Abstraction* , New York: Oxford University Press 2002.

"This paper has been written more from a sense of curiosity than commitment. I was fortunate enough to attend the Munich Conference on the Philosophy of Mathematics in the Summer of 1993 and to overhear a discussion of recent work on Frege's approach to the foundations of mathematics. This led me to investigate certain technical problems connected with the approach; and these led me, in their turn, to reflect on certain philosophical aspects of the subject. I was concerned to see to what extent a Fregean theory of abstraction could be developed and used as a

foundation for mathematics and to place the development of such a theory within a general framework for dealing with questions of abstraction. My conclusions were somewhat mixed: a theory of abstraction could be developed somewhat along the lines that Frege has envisaged; and it could indeed be used as a basis for both arithmetic and analysis. When wedded to a suitable version of the context principle, the theory was capable of accounting for our reference to numbers and other abstract objects. But without the support of the principle, it was not clear that the theory had any great advantage over its rivals. Thus my results would be congenial to someone already committed to the Fregean approach though unconvincing to someone who was not. I therefore present them in somewhat the same spirit as someone who sends off a message in a bottle. I have no desire to announce my communication to the world; but if someone stumbles across it and finds it to be of interest, I shall be pleased.

The paper is in three parts. The first is devoted to philosophical matters, which help explain the motivation for the subsequent technical work and also its significance. It is centred on three abstracts with which they deal? And to what extent can they provide a foundation for mathematics? The second part proposes and investigates a set of necessary and sufficient conditions for an abstraction principle to be acceptable. The acceptable principles, according to this criterion, are precisely determined and it is shown, in particular, that there is a strongest such principle. The third part attempts to develop a general theory of abstraction within the technical limitations set out by the second part; the theory is equipped with a natural class of models; and it is shown to provide a foundation for both arithmetic and analysis. The original version of the paper contained a lengthy section on the context principle. But this acquired a life of its own (just as reference does under the principle); and it has therefore been omitted. I hope to be able to present the material elsewhere." (pp. 503-504)

31. ———. 1998. "Mixing Matters." *Ratio* no. 11:278-288.

Reprinted in: David Oderberg, *Form and Matter. Themes in Contemporary Metaphysics*, Oxford: Blackwell. 1999 pp. 65-75.

Abstract: "Aristotle raised a puzzle about the possibility of mixing whose solution is by no means obvious. I here explicate his solution to the puzzle and attempt to make it plausible within the context of his thought. Although we now know that his specific views on mixing were mistaken, his discussion of the topic raises questions concerning the role of capacities and the relationship of part to whole that are still of interest."

"The topic of mixture plays a central role in Aristotle's metaphysics (1). For every concrete substance is composed of mixtures and underlying every substantial change is a process of mixing.

Thus no understanding of substance or of substantial change is complete without an understanding of mixtures and mixing.

Aristotle's account of mixture may also be of some contemporary interest. For it depends upon a view, still worthy of attention, of how dispositions may conflict. The main text in which mixture is discussed is chapter I.10 of *Generation and Corruption*. Aristotle there raises two puzzles that purport to show that mixing is impossible.

(1) The present paper is a much abridged version of Fine [95].

Many people have helped me develop the ideas in these two papers; and I am especially indebted to the work of Bogen [95] and Code [95].

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Bogen [95] J., 'Fire in the Belly; Aristotelian Elements, Organisms, and Chemical Compounds', *Pacific Philosophical Quarterly*, v. 76, nos 3&4, pp. 370-404.

Code A., [95] 'Potentiality in Aristotle's Science and Metaphysics', *Pacific Philosophical Quarterly*, v. 76, nos 3 & 4, pp. 405-418.

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