specifies how things must be for the proposition to be true; together with a 'way things could be' it determines a truth value. So on this conception, propositions do not (by themselves) determine truth values: by themselves they determine truth conditions, and a truth condition *together with* a 'way things could be' determines a truth value. This idea can also be accommodated in the present framework: it simply depends on the kind of language and model theory we employ. For example, if we use classical FOL, a model assigns a truth value to each wff, and so a proposition (wff plus model) will determine a truth value. If we use instead a system of intensional model theory, then wffs will be assigned intensions by models: functions from indices to truth values. Hence, a proposition (wff plus model) will not determine a truth value: it will determine an intension, that is a truth condition. Together with an index, this intension will determine a truth value. The present framework is, then, quite flexible: it does not foreclose on the decision whether propositions should determine truth values or truth conditions. Furthermore, if the latter, the framework does not foreclose on what needs to be added to a truth condition to determine a truth value: should it be a possible world — or something else? Different options can be accommodated by adopting different systems of intensional model theory with different indices.

Recall the second, parenthesised sentence in the fourth role for propositions in GT: 'It may be that propositions are true or false relative to possible worlds, in which case they are also the bearers of the properties necessary truth and contingent truth.' We have just seen how the idea that a proposition is true or false relative to a world can be accommodated within the current approach to propositions: we use an intensional model theory with worlds as indices. If we do so, then propositions can (in and of themselves) possess properties such as necessary truth or contingent truth. If a model assigns a wff an intension that sends every index to truth, then the proposition comprising that model and that wff will — in and of itself, without outside help or interference — determine the property of necessary truth; similarly for other properties and relations defined in terms of intensions.

In sum: it is indeed hard to see how a structure could interpret itself. The present view of propositions solves this problem by seeing propositions as comprising two elements — a wff and a model — one of which interprets the other. This suffices for purposes of GT. We do not actually need a self-interpreting thing: we just need something that has a truth value (or truth conditions) built-in — something that determines a truth value (or truth conditions). Propositions — on the conception proposed here — do have this desired feature.

Now someone may want to object: ‘But all you have given us is *more structure*! We still need an agent to apply the model part to the wff part. Otherwise all we have is simply more inert machinery. It takes an agent to breathe life into the machinery: to *make* the model interpret the wff.’ My response to this is that it misunderstands the way models work. A model is exactly what we need to add to a wff to determine a truth value (or truth conditions). It is a precise, formally well-defined replacement for the intuitive notion of interpreting a string of symbols. It replaces this vague intuitive notion and does not need to be supplemented by it. Furthermore, if the present objection were a good one, it would not simply count against my view of propositions: it would count against uses of model theory throughout the formal sciences, in which it is understood that models determine values for wffs — by themselves, without need of animation by an act of interpretation or application. So there is a problem here for my view of propositions only if there is also a problem for the whole way that the notion of ‘interpretation’ has been formalised in logic and model theory. But there is no problem: a model is not like a golem.

There is one further issue to discuss before we move on. In the quotation above, King talks of propositions *having truth conditions* and of propositions *representing the world* as being a certain way. He seems to use these ways of talking more or less interchangeably: sometimes he talks of a proposition having truth conditions *and so* representing and sometimes he talks of a proposition representing *and so* having truth conditions. However, at this point in my argument, someone might try to drive a wedge here. They might accept that a wff plus a model determines (all by itself) a truth value or truth conditions and yet still think that a wff plus a model cannot (all by itself) *represent* the world as being some way. Genuine representation (they might say) requires interpretation by an agent: no abstract object (all by itself) can represent the world as being some way. My response to this is that — whether or not this claim about representation is true — it is beside the point: whether determining a truth value or truth conditions suffices for ‘genuinely representing the world as being some way’ does not matter here. The fourth role for propositions in GT is that they are the primary bearers of truth and falsity. What is required for GT is that propositions have built-in truth values or truth conditions; it is not required that they represent the world in any stronger sense than that.

3.3. Unified

The problem of the 'unity of the proposition' is a venerable one, going back at least to Frege and Russell. King [33] usefully distinguishes three questions under this heading. We have already encountered one of them (UQ2) in §3.2. The other two are as follows [33, p. 258]:

> *Unity Question* 1 (UQ1): What holds the constituents Dara and the property of swimming together and imposes structure on them in the proposition that Dara swims?
> *Unity Question* 3 (UQ3): Why does it at least seem as though some constituents can be combined to form a proposition (Dara and the property of swimming), whereas others cannot be (George W. Bush and Dick Cheney)?

Both of these questions are readily answered given the theory of propositions presented in this paper. Let's discuss them in turn.

UQ1. Here we may distinguish two questions: What holds the wff together? What holds the wff and the model together? We have already discussed the second question: nothing mysterious is required to *apply* the model to the wff. As for the first question, we can *again* distinguish two questions. The first is: What stops the wff falling apart into a bunch of separate constituents — that is, how does the wff stay together *at all*? The response is that if there were a problem about how wffs manage to hold together it would not just be a problem for my view of propositions: it would be a problem for all of the formal sciences. Now the reader may be getting tired of this kind of response — but in fact the ability to deploy this kind of response is one of the great advantages of the present view of propositions. Once again, what we are seeing here are the benefits of using tried-and-tested, off-the-shelf materials to construct propositions. The second question is: What makes the wff stay together *in the right way*? For example, in Pa, what makes the first constituent the part that picks out a certain property and the second the part that picks out an individual, in such a way that the proposition as a whole is true iff the individual has the property? We have essentially already answered this question in the previous section. It is the way the parts of the wff are treated by the *model* that ensures these things. For example, in Pa, what makes P the predicate (the part that picks out a property) and a the name (the part that picks out an individual) is the role each plays in determining a truth value for Pa in a model.

UQ2. Whatever formal language we are using, only some combinations of symbols constitute wffs. There may therefore be groups of symbols such that *no* combination of them is well-formed. In FOL, for example, one can form a wff from a name and a predicate, but not from two names.

3.4. Language- and Mind-Independent

We mentioned in §3.1 that Soames was driven to the view that propositions are cognitive acts — and in §3.2 that King was driven to the unorthodox view that propositions are *not* mind- and language-independent — by worries about how propositions could be capable intrinsically (by their very nature — rather than because they are interpreted in a certain way) of having truth values or truth conditions. We have also seen how propositions on the present proposal — wffs plus models — avoid this worry and manage to carry within themselves (without assistance from external acts of interpretation) truth conditions or truth values. It is now time to clarify that propositions on the present proposal *are* mind- and language-independent and to explain why this is a desirable feature in a theory of propositions.

Propositions on the present proposal comprise two things: a wff and a model. Both are taken straight off the shelf — without modification — from the equipment repository of logic and the formal sciences. As we have already noted, they are abstract objects: denizens of the same realm as other entities countenanced in mathematics such as sets, numbers, functions, algebras, metric spaces and probability measures. Note that some of these things might have concrete objects built into them: for example sets with urelements, probability measures over a population, or models that assign Spot, Rover and Tangles as referents of certain names. Nevertheless they are all abstract objects: the set containing two persons is a third object but it is not a third concrete object; the function sending each person to his or her biological mother is another thing in addition to the persons in question but not another physical thing; and so on. Propositions, then — on the present conception — are mathematical objects and are no more mind- or language-dependent than any other such objects.

Of course there are positions in the philosophy of mathematics according to which all mathematical objects are mind- or language-dependent. (There are also views according to which mathematical objects such as sets are concrete objects.) It is beyond the scope of this paper to argue against such views — both in the sense that it would take too long and in the sense that it is unnecessary: it is enough for purposes of the present paper to locate propositions with apparently paradigmatic mind- and language-independent things such as numbers and sets, as opposed to paradigmatic mind- or language-dependent things such as cognitive acts and sentences of natural languages. The key point is that propositions belong with mathematical entities, not with things like cognitive acts or bits of natural languages.

Why is mind- and language-independence (in at least this relative sense) a good thing? The answer relates to role 3 for propositions in GT. Propositions are supposed to provide a neutral bridge — of common content — between natural languages, between attitudes (of the same agent and of different agents) and between languages and attitudes. Propositions should be potentially common to all public languages and to all languages of thought — to persons, animals, computers and in general any agent whose behaviour might usefully be explained by GT. According to role 3, propositions should be *common currency*. Now if propositions incorporate parts of natural language, or parts of a language of thought, or types of cognitive act — in general, if they are not mind- and language-independent — then they cannot play this role in GT of being the neutral bridge between minds and languages of all kinds.[28]

A couple of clarifications need to be made at this point. The first is that we are arguing that propositions need to be mind- and language-independent if they are to serve the purposes of GT. If we want 'propositions' for some other purpose — for example, giving a formal semantic analysis of attitude reports (cf. §1.1) — then the present point might not apply. (Of course, sententialist approaches to the analysis of attitude reports face other well known problems.)[29] The second is that there is a

[28] In §3.5 we shall see that propositions should be the objects of logic. But as Frege taught us, logic is not mind-dependent. (See e.g. Frege's Introduction to *Grundgesetze* [17]. For more detailed discussions of and references to Frege's anti-psychologism see Smith [54, §II] and [56, §3.3].) This gives us another reason for thinking that propositions must be mind-independent. Another reason for thinking that propositions must be language-independent stems from the idea that the association of expressions with meanings is *conventional*: as Cresswell [12, p. 9] puts it, expressions and meanings "must be mutually independent things (whatever their nature), which, in a given language, happen to be correlated in some particular way."

[29] Cf. e.g. Church [10], Salmon [51], Soames [59, ch. 7] and Higginbotham [28, §2]; and Montague [42] and Thomason [64].

range of sententialist views and the present point does not count against all of them. Some take propositions to be sentences of public natural languages. Others take propositions to be (interpreted) LFs (logical forms), where LFs are theoretical entities posited in (certain areas of) linguistics. Within the latter camp, different views can again be distinguished. Some take LFs to be abstract objects: objects of the kind I have taken wffs to be. Others take them to be mental representations.[30] The points above about mind- and language-independence count against versions of sententialism that take propositions to be sentences of public languages or mental entities. They do not count against versions of sententialism that take propositions to be LFs where these are thought of as abstract entities on a par (ontologically) with wffs. Such versions of sententialism face a different problem, however, which is that they *enforce* an overly fine level of granularity. If two natural language sentences have different LFs — according to best linguistic theory — then they cannot express the same proposition. As I shall argue in §3.7, we do not want a theory of propositions to enforce any such fineness of grain (or coarseness of grain). This is a reason against identifying the wff part of the proposition expressed by a sentence with a representation of the *syntax* of that sentence itself — whether the surface syntax or an underlying logical form.

One issue that we should discuss here is the worry — which someone might have at this point — that if propositions are abstract objects on a par ontologically with other mathematical entities then we face a version of the problem for platonism posed by Benacerraf [6] and sharpened by Field [14]. In essence, the problem for platonism is to explain how we could know any mathematical truths or have reliable beliefs about mathematical entities given that these entities are mind- and language-independent, non-physical and non-spatio-temporal. However, two points prevent this problem transferring to the present view of propositions. The first is that I have not committed to platonism. I have simply said that propositions on my view are ontologically on a par with other mathematical entities such as sets, numbers, functions, algebras, metric spaces and probability measures. What the correct position on the ontology of these entities *is* is a question for philosophy of mathematics and not one on which I need to take a stand in this paper. The second point is that the role played by propositions in GT is very

[30] For discussion see e.g. Katz and Postal [31], Higginbotham [27] and Collins [11].

different from the role played by mathematical entities in an account of our mathematical practice. In the mathematical case, part of what needs explaining is how we know mathematical truths. If the things that make these truths true are utterly isolated from us then there is an at least apparent worry about how we can know these truths. The case of propositions has a quite different structure. GT is an explanatory theory but the phenomena to be explained do *not* include agents knowing things *about propositions*. Propositions feature in an account in which agents reason, know and communicate. The agent knowing that Bob is in Stockholm (say) is modelled in terms of a relation between the agent and a proposition. This is different from saying that the agent knows some fact *about this proposition*. Hence no worry looms about *how* the agent could possibly know what she knows.

At this point a different worry might arise. How could it possibly be *useful* to model an agent's knowing that Bob is in Stockholm (say) in terms of a relation between the agent and a proposition? This is an interesting question but it falls well outside the scope of the present paper. The dialectic is as follows. GT is a useful explanatory theory. (It is useful because it allows us to explain and predict the behaviour of agents to a degree that we could not possibly hope to achieve by other known means — for example, by viewing them as physical entities and applying the laws of physics. If you want to know where Bob will be tomorrow morning given what he just said to you and what you have observed of his behaviour in the past, do not try applying fundamental physical laws — or biological or chemical laws for that matter. Your best shot is to use the resources of GT.) Now we want to know what propositions could be for purposes of GT. I have proposed an answer and am in the process of describing the virtues of this account of propositions. Now someone wants to know: How does GT manage to be useful? How *could* a theory be useful for explaining the behaviour of certain things (in this case, the behaviour of agents when they reason, communicate and act) when the theory involves further theoretical entities, beyond the ones whose behaviour we originally wanted to explain? This is a general question about the explanatory success of theories. It is a central topic in philosophy of science. But (as noted) there is no serious prospect of useful explanations in purely physical terms of the phenomena that we seek to predict and explain using GT. Hence even in the absence of an answer to the question as to why GT works and how the theoretical entities it involves relate to physical entities, we are entitled to go on using and developing GT. In general, we are entitled to go on using and developing theories that have explanatory power even in the absence of answers to fundamental questions in the philosophy of science. It is in the spirit of developing GT that I am proposing an account of propositions for purposes of GT. The question of why and how GT is successful is one for another occasion.

In this light, consider role 1 for propositions in GT:

> Propositions are the objects of the attitudes such as belief and desire.

One might wonder how propositions could be the objects of the attitudes if propositions are abstract entities (as opposed to e.g. cognitive acts). This will indeed start to seem mysterious if we picture Ed's believing that he is walking his dog to involve Ed's being attached by some kind of ultrafine string to a proposition in Plato's heaven or Frege's third realm in something like the way he is attached to his dog by the dog's lead. But this is just a misleading picture. GT is an explanatory theory that posits certain entities and relations to them in order (partly) to derive predictions about and explanations of behaviour (e.g. Ed's walking his dog now rather than at his usual time, having just looked at a newspaper warning of a torrential downpour later in the day). There is a question about how different levels of explanation coexist: of how the explanation of Ed's movements in terms of his beliefs relates to an explanation in terms of physical forces. But this kind of question is quite general and poses no special problem for explanatory theories that invoke propositions understood as abstract objects. The reason why we should accept that Ed stands in a certain relation to a proposition is that our best explanatory theory posits such an entity and a relation between it and Ed.

3.5. The Role of Logic

One of the roles for propositions mentioned in §1 has been relatively neglected in the literature: the role of propositions as the objects of logic. This role is of crucial importance if logic is to provide norms for belief — and as we shall see, the present view of propositions is uniquely well placed to explain how propositions could be the objects of logic.

Before continuing, I should clarify that I am not suggesting that the primary business of logic is providing norms for belief. I am also not suggesting that norms for belief can be derived in a *simple* way from logical laws — for example, the validity of modus ponens does *not* generate the norm 'If you believe α and $\alpha \to \beta$ then you should believe β'. These points have been well made by Harman and others.[31] Nevertheless, even if the route is indirect and complex, logic is a source of norms for belief: in managing one's doxastic affairs, logical considerations are indeed relevant. Furthermore, we can extend our knowledge using logical deduction. If the objects of the attitudes are propositions then none of this will make sense unless we can explain how logic gets a grip on propositions.

The objects of the logical properties — logical truth, satisfiability and so on — and the relata of the logical relations — equivalence, logical consequence and so on — are wffs and sets (or sequences etc.) of wffs. This is so whether one takes the fundamental definitions of these properties and relations to be model-theoretic (e.g. logical truth is truth on all models; satisfiability is joint truth on some model; logical consequence is truth of the conclusion on every model on which all the premisses are true; and so on) or proof-theoretic (e.g. logical truth is provability from no assumptions; logical consequence is derivability of the conclusion from the premisses taken as assumptions; and so on). By putting wffs at the heart of propositions, the view of propositions presented in this paper can therefore allow propositions to play role 5 on the list of roles for propositions in GT: the role of connecting up *logic* with the objects of *belief*. If the objects of belief are propositions and propositions are wffs plus models, then it is evident how logic can provide norms for beliefs — for example, one should not believe an unsatisfiable set of propositions (or more precisely, a set of propositions whose wff components form an unsatisfiable set) — and how logical inferences can be used to derive further beliefs from existing beliefs.

Note that it is not part of the present view that propositions are the objects of logic (hence the parenthesised remark in the previous sentence): the objects of logic are wffs, and propositions are wffs *plus models*. The situation is similar to the one encountered in §3.2, where we saw that propositions as a whole do not have to bear truth values in order for them to play role 4 on the list of roles for propositions in GT. Here too, it is enough for propositions to play role 5 that they have parts — the wff parts — that bear logical properties and stand in logical relations.

[31] See e.g. Harman [22], Field [15] and Harman [23].

By getting a direct grip on the wff parts of propositions, logic gets an indirect grip on propositions as a whole — and this is sufficient for role 5.

Other views of propositions, by contrast, cannot allow that (parts of) propositions are the objects of logic. First, consider the four theories of structured propositions introduced in §2. Recall the three kinds of entity distinguished there: (A) sentences of a natural language such as English; (B) corresponding wffs of some formal language $\mathcal{L}$; (C) models of (fragments of) $\mathcal{L}$. As we noted, the theories of structured propositions all locate propositions at level C. But the objects of logic are the things that get assigned values — not the values assigned. This is so even on views that take the proof-theoretic definitions of the logical concepts to be primary. Even if it is not the fundamental fact about logical truth (say) that logical truths are assigned the value true on all models, it is still a fact: the thing that is proven — a wff — is the same thing that is assigned values in models. The logical truth is the thing to which values can be assigned: it is not one of the values. The same goes for the other logical properties and relations: the things that bear them and stand in them are the things to which values get assigned. If these things are parts of propositions — as they are on the present view — then logic gets a grip on propositions. But if propositions are just made up of the values assigned — and not the things that get assigned these values — then logic does not get a grip on propositions.

Let's turn now to the next view of propositions considered in §2: the view of propositions as sets of possible worlds. This view too fails to allow logic to get a grip on propositions. Admittedly the view gives us something (not absolutely nothing) in this area: a set Γ of propositions can be said to entail a proposition α iff the intersection of all the propositions in Γ is a subset of α; a set Γ of propositions can be said to be satisfiable iff the intersection of all the propositions in Γ is nonempty; and so on. However this only gives us Boolean properties of, and relations between, propositions — and furthermore even in this limited realm what we are getting here isn't *formal logic* and does not plausibly provide norms of rationality. Although it is common in introductory logic textbooks nowadays to define logical consequence (aka validity) as necessary truth preservation, this property is not in fact something of which formal logic provides a theory. Formal logic gives a theory of necessary truth preservation *in virtue of form*.[32] That is, a logically valid argument is necessar-

[32] For a more detailed discussion of these issues see Smith [57, §1.4].

ily truth preserving — it is impossible for the premisses to be true while the conclusion is false — but that is not all: a logically valid argument is furthermore necessarily truth preserving *in virtue of its form*. It is not something special about the *subject matter* of the argument that ensures that it is necessarily truth preserving — for example, the premisses talk about water and the conclusion talks about H_2O — rather, it is simply *the way the argument is put together* that ensures that the premisses cannot be true and the conclusion false. Despite the recent tendency to introduce validity in terms of necessary truth preservation (alone), historically at least it was always clear that the notion of logical validity required something more than this: it required that the argument be necessarily truth preserving *thanks to* its form or structure. For example, this view can be found in Tarski's seminal discussion of logical consequence, where it is presented as the traditional, intuitive conception:[33]

> I emphasize [...] that the proposed treatment of the concept of consequence makes no very high claim to complete originality. The ideas involved in this treatment will certainly seem to be something well known [...]. Certain considerations of an intuitive nature will form our starting-point. Consider any class K of sentences and a sentence X which follows from the sentences of this class. From an intuitive standpoint it can never happen that both the class K consists only of true sentences and the sentence X is false.[34] Moreover, since we are concerned here with the concept of logical, i.e. *formal*, consequence, and thus with a relation which is to be uniquely determined by the form of the sentences between which it holds, this relation cannot be influenced in any way by empirical knowledge, and in particular by knowledge of the objects to which the sentence X or the sentences of the class K refer[35] [...]. The two circumstances just indicated[36] [...] seem to be very characteristic and essential for the proper concept of consequence [...]. [62, pp. 414–415]

Indeed, the idea goes back to Aristotle [2], who begins by saying:

> A deduction is a discourse in which, certain things being stated, something other than what is stated follows of necessity from their being so. [§1]

[33] The footnotes to the quotation are mine, not Tarski's.

[34] This is the idea that the argument should be necessarily truth preserving.

[35] This is the idea that the argument should be necessarily truth preserving *in virtue of its form*.

[36] That is: (i) necessarily truth preserving; (ii) guaranteed by form.

This is the idea of necessary truth preservation. Then, when discussing arguments, Aristotle first presents an argument form in an abstract way, with schematic letters in place of particular terms — for example:

Every C is B.
No B is A.
Therefore no C is A.

He then derives specific arguments by putting particular terms in place of the letters — for example:

Every swan is white.
No white thing is a raven.
Therefore no swan is a raven.

The reasoning that shows the argument to be necessarily truth preserving is carried out at the level of the argument form (i.e. in terms of A's, B's and C's, not ravens, white things and swans): it is thus clear that Aristotle is interested in those arguments that are necessarily truth preserving *in virtue of their form*.

Now the view of propositions as sets of possible worlds can reconstruct a relation of entailment between propositions — but this relation only captures the idea of necessary truth preservation: it misses the idea that logical validity depends on form. Of course it must do so, because propositions are unstructured on this view. The point now is that this is a problem: it renders this view of propositions unable to say that logic is concerned with (parts of) propositions — because, as we have seen, logic is essentially concerned with structured entities, with entities that have forms. This is not just a curiosity: it matters for GT. Logical consequence (and other logical properties and relations) yield norms for belief; mere necessary truth preservation (and other properties and relations definable in terms of sets of possible worlds) do not — thanks to the existence of a posteriori necessities. Someone who believes $\forall x Rx$ and $\neg Ra$ is irrational; someone who believes that the glass contains water and does not contain H_2O might not be irrational — he might simply not have learned chemistry.

The upshot so far is that if we want propositions for purposes of GT, then we need them to be governed by formal logic, which yields norms of rationality. Views of propositions as unstructured sets of worlds cannot allow this, and nor can views of propositions as structured entities comprising things like the *values* assigned in models to expressions of a logical language — rather than the expressions themselves (which are the things that bear logical properties and stand in logical relations).

We turn now to the final kind of view considered in §2: sententialism. Sententialist views face no essential structural problem of the sort just discussed. The structure of the sententialist view is the same as the structure of the view presented in this paper: propositions comprise a structured sentence-like part together with values for the expressions occurring therein. In theory, then, logic can get a grip on propositions, for they contain a part which is both structured and comprises things that get assigned values (rather than the values themselves). The problem for sententialism is that logic is not concerned with anything as parochial as the sentences of a natural language. If anything is mind- and language-independent, logic is. Well, let's be a bit more subtle. Of course there are many logics, used for all sorts of purposes, and taking all kinds of things as their objects. But for purposes of GT, 'logic' is supposed to be an independent arbiter. In GT, we do not want one logic for each language: we want one logic for all propositions. Hence we do not want logic to be tied specifically to natural language.

One point requires discussion before we move on. It is often claimed that the objects of logic — the bearers of the logical properties and the relata of the logical relations — are sentences (and sets thereof) as opposed to propositions.[37] This claim can be understood in several different ways. On one reading the claim is that traditional (Fregean or Russellian) propositions are not the objects of logic; rather, the objects of logic are sentence-like structures where the objects occupying the positions in these structures are expressions of some sort (as opposed to values that might be assigned to expressions in a semantic system). I have already argued for this claim. On another reading the claim is that the objects of logic are natural language sentences. My response to such a claim is as follows. Whenever we have a language meeting certain syntactic constraints — for example, all its sentences are generated from a stock of basic symbols using a finite number of syntactic operations — we can define logics (whether proof-theoretically or model-theoretically) that take as their objects the sentences of that language. However, as already mentioned, 'logic' in the sense required for GT is supposed to be an independent arbiter: a supplier of universal norms that apply equally to any creature or entity capable of believing or expressing propositions

[37] For a recent example see Russell [49, n.1]. For detailed discussion and references see Smith [58]. Sometimes it is said that the objects of logic are sentences and/or sentence *schemata*.

by whatever means. So logic in the sense needed for GT cannot take as its objects the sentences of a natural language.

3.6. The Formal Semantics Interface

Recall role 2 for propositions in GT:

Propositions are expressed by sentences uttered in contexts.

We express propositions by uttering sentences — and we recover the proposition expressed by an utterance by computing on the meanings (csv's) of the words used, the syntax of the sentence and facts about the context of utterance. But as we have already remarked (§1.1), none of this *requires* that propositions *be* the csv's of sentences. Propositions do not have to feature in formal semantics at all. Role 2 imposes a requirement on the *interface* between GT and formal semantics. The requirement is that sentences uttered in contexts must be able to determine propositions. On the present view of propositions, there is in principle no problem in this area.[38] Formal semantics will deal with formulas of some sort, whether sentences of natural language, LFs or wffs of IL (to mention a few possibilities). It will also assign csv's to the components of such formulas. All we need is that such a formula together with csv's determine a (different) wff together with a model.[39] There is no reason to foresee a problem here. Of course if the language of formal semantics was very simple and the language of propositions was a different and more complex language — or if we used an extensional formal semantics but wanted intensional models at the level of propositions — then there would be potential problems. But such considerations only feed into the particular choice of formal languages and models for semantics and for

[38] Of course the exact details will depend on the details of our formal semantic theory and on the details of our theory of propositions — i.e. from exactly what kind of formal language the wffs are drawn and exactly what kind of models are in play. As mentioned in §2, it is not the purpose of this paper to settle such matters of precise detail.

[39] We gave reasons in §3.4 why, in general, the very same formula should not be used both to represent a sentence of natural language and to represent the wff part of the proposition expressed by that sentence in a context. We left it open however (§2) whether the language of formal semantics — the language from which the formulas that represent sentences of natural language are drawn — should be the same as or distinct from the language of propositions — the language from which the wff parts of propositions are drawn.

propositions — they do not in any way pose a general problem for the present conception of propositions.

3.7. Granularity

All the other theories of propositions that we have mentioned force us in certain circumstances to identify or to distinguish propositions in ways that lead to problems of granularity. The view of propositions proposed in this paper, by contrast, does not face a granularity problem in any of these situations.

Let's begin with the most famous problem in this area: Frege's puzzle [16]. Consider a theory of propositions according to which a sentence S expresses a structured proposition P such that the structure of P corresponds to the structure of S, and where S contains a name the corresponding element of P is the referent of that name. Such a theory is forced to say that 'Hesperus is Hesperus' and 'Hesperus is Phosphorus' express the same proposition.[40] It then becomes hard to see how it could be that someone might find the latter informative but not the former or how someone might believe the former but not the latter. Now of course I am not saying that this problem is insuperable for the kind of view of propositions that we have just mentioned: various responses have been proposed.[41] My point here is just that the view of propositions presented in this paper does not face this problem because it does not force us to identify the propositions expressed by 'Hesperus is Hesperus' and 'Hesperus is Phosphorus'. It allows us to say that the wff part of the proposition expressed by 'Hesperus is Hesperus' is something like $h = h$ while the wff part of the proposition expressed by 'Hesperus is Phosphorus' is something like $h = p$. Thus even if h and p get assigned the same values in the model parts of these two propositions, still the propositions are distinct. (Another advantage of this view is that we can say that the former proposition is logically true while the latter is not — even if both are necessarily true. Cf. §3.5.)

Next let's consider the view to which Frege was led by his own puzzle, according to which propositions are again structured entities but where

[40] 'Hesperus' is a name given to the evening star: the first object visible in the sky as night falls. 'Phosphorus' is a name given to the morning star: the last object visible in the sky as dawn approaches. It turns out that the evening star and the morning star are both the planet Venus.

[41] See e.g. Salmon [50], Braun [7] and Soames [59].

the part of the proposition corresponding to a singular term is not the referent of that term but a mode of presentation of the referent [16]. Suppose Bill says 'I am fond of oranges' and Ben hears him and — we want to say — believes what he says. The problem is that the sense of 'I' as Bill used it seems to be a special first person mode of presentation of Bill to which Ben does not have access: hence Ben cannot believe a proposition that has this mode of presentation as a component. When Ben says 'Bill is fond of oranges' the proposition he expresses contains a different mode of presentation of Bill. Hence the Fregean seems forced to distinguish two propositions here in a way that threatens to make communication problematic.[42] The view of propositions presented in this paper does not face any such problem because it does not force us to distinguish the propositions expressed by 'I am fond of oranges' (said by Bill) and 'Bill is fond of oranges' (said by Ben). There is no reason at all on this view why both sentences cannot be taken to express the very same proposition.

Let's consider another case in which a view of propositions is forced to distinguish propositions in a way that seems problematic. Any sententialist view which takes the proposition expressed by a sentence to incorporate the sentence itself must distinguish the propositions expressed by utterances of distinct sentences (as opposed to two utterances of the same sentence). Thus a version of sententialism that takes sentences of natural languages in something like the ordinary sense to be parts of propositions will be forced to deny that sentences of different languages can express the same proposition while a version of sententialism that takes LF's in the sense of some syntactic theory in linguistics to be parts of propositions — while it *can* hold that sentences of different natural languages might have the same LF — will nevertheless be held hostage by that syntactic theory and will be forced to distinguish the propositions expressed by sentences with different LF's. In particular, both kinds of view will be forced to deny that all of the following sentences can express the same proposition:[43]

- Snow is white
- Schnee ist weiss (German)
- Snö är vitt (Swedish)

[42] Again, I do not mean to suggest that the objection is insuperable: responses have been proposed. For the objection and some responses see e.g. Perry [44], Kaplan [30], Perry [45], Evans [13] and Heck [24].

[43] These examples are from Ripley [48, pp. 12–3].

- La nieve es blanca (Spanish)
- Yuki-wa shiroi-des (Japanese)
- Ha-shelleg lavan (Hebrew)
- Nix nivea est (Latin)

The view of this paper, by contrast, faces no such problem: on this view we are never *forced* to distinguish two propositions based on syntactic properties of the sentences used to express them.

Let's now consider another case of the kind that arose in connection with Frege's puzzle: a case where a view of propositions forces us to identify certain propositions. Views of propositions as sets of possible worlds force us to identify the propositions expressed by sentences true at exactly the same worlds. Thus, for example, all necessarily true sentences will express the same proposition. The present view, once again, enforces no such identification.[44]

Let's turn now to Kripke's puzzle [34]. Pierre, living in France, sincerely asserts 'Londres est Jolie'. Later, living in London, he sincerely asserts 'London is not pretty'. Intuitively Pierre is not illogical or irrational: he simply does not realise that the city in which he now lives is the very city he once referred to as 'Londres'. The problem is that certain views of propositions force us to the conclusion that Pierre is illogical: that he believes a proposition P (the one he expresses by saying 'Londres est Jolie') and also its negation (which he expresses by saying 'London is not pretty'). The present view of propositions, however, does not force us to identify the proposition that Pierre expresses by uttering 'London is not pretty' with the negation of the proposition that he expresses by uttering 'Londres est Jolie'. We are free to represent the wff parts of the propositions in question as follows (using FOL as the language from which the wff parts of propositions are drawn, for the sake of illustration):

- Londres est jolie: Js
- London is not pretty: $\neg Pn$

Now we may suppose that Pierre believes propositions whose wff components are as follows (the third corresponds to his knowledge that 'pretty' translates 'jolie'):[45]

[44] Note that even if we adopt an intensional model theory, the present view of propositions can avoid the problem of hyperintensionality. We are not forced to identify propositions whose model parts assign the same intensions to corresponding wff components — because the wff parts themselves might be different.

[45] Alternatively we could forget about the third wff altogether and just represent 'Londres est jolie' as Js and 'London is not pretty' as $\neg Jn$.

- Js
- $\neg Pn$
- $\forall x(Px \leftrightarrow Jx)$

This is a consistent set of wffs. If we add the wff $s = n$ — which is something *we* believe — then we get an inconsistent set. But the point of the story is that Pierre does not believe a proposition with wff component $s = n$. This is how it can be the case that Pierre is not illogical or irrational.[46]

Kripke's Paderewski case can be handled in a similar fashion. Not realising that the Polish pianist and composer called 'Paderewski' is the same man as the Polish Prime Minister called 'Paderewski', Peter sincerely asserts 'Paderewski had musical talent' (thinking of the composer) and later 'Paderewski had no musical talent' (thinking of the politician). Intuitively Peter is not illogical or irrational: he simply fails to realise that there is only one man called 'Paderewski' in question. The kind of view of propositions I am proposing allows the situation to be handled straightforwardly. It allows us to say that the wff component of the proposition that Peter expresses when he says 'Paderewski had musical talent' is something like Tm while the wff component of the proposition that Peter expresses when he says 'Paderewski had no musical talent' is something like $\neg Ts$ — and Peter does not believe any proposition with wff component $m = s$. Hence the wff components of his beliefs form a consistent set and he is not illogical or irrational — he simply lacks some knowledge.[47]

3.7.1. Anything Goes?

The upshot of §3.7 is that the present view of propositions does not *enforce* any level of granularity, be it fine or coarse. We can see quite different sentences (sentences of different languages, and sentences with different LFs) as expressing the same proposition and we can see the very same sentence as expressing different propositions on different occasions

---

[46] If Pierre does learn that Londres is London — i.e. $s = n$ — then in order to maintain consistency he will need to reject one of Js and $\neg Pn$ (assuming he still believes $\forall x(Px \leftrightarrow Jx)$). Presumably he will do so! If he does not, then intuitively he *is* irrational.

[47] Sententialists can handle the Londres/London case in the same kind of way I do because there are two different words in play ('Londres' and 'London'). Sententialists have more trouble with the Paderewski case because there seems to be only one word in play ('Paderewski').

of use. Now this level of flexibility might engender the worry that there is too much freedom: that propositions are underdetermined. This worry is out of place. Recall the dialectic. We are trying to say what propositions could be for purposes of GT. Sometimes in GT we want fine-grained propositions (e.g. we do not want to be forced to say that Pierre or Peter is irrational and we do not want to say that someone who believes that $2+2=4$ automatically believes that water is H_2O) and sometimes we want coarse-grained propositions (e.g. we want to be able to allow that the proposition expressed by Bill when he says 'I am fond of oranges' might be the same as the proposition expressed by Ben when he says 'Bill is fond of oranges' and we want to be able to allow that the same proposition can be expressed by sentences in different languages with different syntactic structures). The present view of propositions *allows* what we want, while other views *enforce* overly fine or overly coarse levels of granularity in certain situations. This is a major advantage of the present view.

Now someone might object that what we want from a theory of propositions is a deterministic or algorithmic theory that tells us exactly which proposition is expressed by which sentence in which context, which proposition is believed by which agent in which situation, and so on. But that was never my task in this paper. The aim was to make available the resources needed for GT: to say what propositions might be for purposes of GT. The aim was not to complete GT, or even a particular fragment of GT. Distinguish two tasks:

1. Saying what kinds of things propositions are.
2. Giving a theory that associates specific propositions with specific utterances.

Now consider Frege's puzzle. A theory at level 1 (i.e. a theory that tries to perform the first of the two tasks just mentioned) just tells us what kind of thing a proposition is. A theory at level 2 tells us exactly which proposition is expressed by an utterance of 'Hesperus is Phosphorus' in some context C, which proposition is expressed by an utterance of 'Hesperus is Hesperus' in C, and whether they are the same proposition. Now I have taken the problem to be that certain theories at level 1 *enforce* certain bad answers at level 2. And the advantage of the kind of theory I have offered at level 1 is that it *allows* the kinds of answers we intuitively want to give at level 2. But I have not given a theory at level 2 at all. I take giving such a theory to be part of completing GT and/or part of the project of formal semantics (which, as discussed earlier, has an interface with GT). I am not claiming to have a theory (at level 2) that *generates* the results we intuitively want about Frege's puzzle, Kripke's puzzle and so on. I claim only that the theory I have given (at level 1) does not — unlike other theories (at level 1) — preclude giving a theory at level 2 with the intuitively correct results. Actually giving such a theory at level 2 was never on the agenda in this paper.

Still, there might be a residual worry here, which is that the price of not enforcing bad answers at level 2 is the opening up of *too many* possibilities in a way that makes the task of giving a theory at level 2 highly problematic. The worry is that no theory at level 2 will ever be able to say that sentence S in context C expresses proposition P because there will always be other equally good candidate propositions besides P — differing from P in their wff components — and nothing to decide between them. For example, I have claimed that my theory of propositions — at level 1 — allows for theories at level 2 according to which the wff part of the proposition expressed by 'Hesperus is Hesperus' is something like $h = h$ while the wff part of the proposition expressed by 'Hesperus is Phosphorus' is something like $h = p$. The objection now is that no theory at level 2 which made such claims about the propositions expressed by these sentences could ever be warranted because there would always be equally good rival theories that identified the wff parts of these propositions differently.

One reason one might think this has to do with the worry, raised by Benacerraf [5], that we cannot identify the numbers with any particular bunch of set-theoretic entities (e.g. the von Neumann ordinals) because there are always other candidate targets for the reduction and nothing to favour one of these bunches of set-theoretic entities over the others. A problem of this sort arises for anyone who countenances abstract objects of any sort. The question arises whether these abstract objects can be identified with set-theoretic entities. If they can be identified — in one way — then the problem arises that they can also be identified in other ways and there seems to be nothing to favour one identification over the others. This is a quite general problem and I shall not propose any solution to it here. If I can show that there is a reasonable prospect of favouring some theory at level 2 that associates a proposition P with a certain sentence S over rival theories (that associate with S propositions that differ from P over their wff components) then I shall take my work to be done: the problem that the wff component of P (which is an abstract object) could still then be identified with many different set-theoretic entities — that is, the Benacerraf problem — is a quite general problem and one for another day.

Setting aside now the Benacerraf problem of how one might identify a given wff — an abstract object — with some set-theoretic entity, still there are reasons for thinking that no theory at level 2 that associates a certain sentence S with a proposition P could ever be preferred over rival theories that associate S with propositions that differ from P over their wff components. First, there is the issue of choosing the formal language from which the wffs are drawn. Won't there be a limitless number of equally good alternatives and hence won't the choice of one formal language be completely arbitrary? I don't think so. There are serious constraints here. For example, the formal language should be such as to support an appropriate logic and it should also be such as to support a suitable interface with formal semantics. Now in the literature on logics of belief revision (for example) and in the literature on formal semantics one finds debates about the appropriate underlying formal language. However, one does not find a ridiculously large number of live alternatives. It is a deep and interesting question — and one that is (as I have already mentioned) beyond the scope of this paper — what kind of formal language will work best here: but I see no reason to think that there will be a vast number of equally good alternatives. Of course there may be more than one viable alternative with no single absolutely clear best choice: but this is not any new kind of problem. Recall that — on the approach to propositions taken in this paper — our reason for believing in propositions at all is that they play a role (several roles) in a successful explanatory theory: GT. Empirically equivalent theories are ubiquitous. We should not expect that theories involving propositions — in this case, GT — will magically be immune from having empirically equivalent alternatives when it is well known that theories in many other areas have such alternatives. Our goal here cannot be to show that there will be just one correct formulation of GT: it can only be to show that any theoretical indeterminacy here will be of a familiar sort and at familiar levels.

OK, so suppose we have fixed on a formal language from which the wff components of propositions are to be drawn. For the sake of example, let's suppose it's FOL. Further problems loom. In order not to deem Peter illogical we need to suppose that his utterances of sentences involving the name 'Paderewski' fall into two groups: some of them express propositions whose wff parts feature one name and others express propositions whose wff parts feature a different name. But now focus on the utterances in just one of these groups. If we can get an empirically adequate theory by associating them all with propositions whose wff parts feature a single name (say p) then can't we get an equally empirically adequate theory by associating them with propositions whose wff parts feature *different* names $(p_1, p_2, \ldots, p_n)$ *and* supposing that Peter also believes propositions with wff parts $p_1 = p_2$, $p_2 = p_3$, $\ldots$, $p_{n-1} = p_n$? But then what is to decide between these theories? It seems to become completely arbitrary whether we think Peter expresses two propositions involving the same name or two propositions involving different names, when he makes two utterances of sentences involving the name 'Paderewski'. There is a straightforward response to this problem: simplicity. In developing GT, we should endeavour to find the simplest theory that fits the phenomena. Of course there may sometimes be ties and trade-offs, but this is — once again — a familiar issue with empirical theories, not some special new problem facing the theory of propositions presented in this paper. Once again, our goal here cannot be to show that there will be just one correct formulation of GT: it can only be to show that any theoretical indeterminacy here will be of a familiar sort and at familiar levels.

Consider a third and final kind of problem case. For any implementation of GT in a particular area — say, in an explanation of the behaviour of some agents — there will be a different, empirically equivalent implementation that differs from the first by uniform substitution of symbols in the language of propositions. For example, we could take Pierre to believe propositions whose wff components are Js, $\neg Pn$ and $\forall x(Px \leftrightarrow Jx)$ — or Kt, $\neg Qo$ and $\forall y(Qy \leftrightarrow Ky)$. As long as the substitution is uniform, this will make no difference. But then what is to decide between these theories? It seems to become completely arbitrary whether Pierre believes a proposition with wff component Js or a proposition with wff component Kt. My response to this is that these are not two distinct theories at all: they are notational variants of the same theory. The content of this theory is that Pierre believes propositions with wff parts where the same symbol occurs here and here and here, a different symbol occurs here and here, a different symbol again occurs only here, and so on. We can express this by labelling the first symbol just mentioned J, the second one s, and so on — or we can express it by labelling the first symbol just mentioned K, the second one t, and so on. But either way, we are expressing the same theory. And once again, it is a familiar fact — rather than a special problem facing the theory of propositions presented in this paper — that there can be different notational variants of a single empirical theory.

4. Conclusion

In this paper I have presented a new theory of propositions, according to which propositions are abstract mathematical objects: wffs together with models. I have distinguished the theory from a number of existing views and explained some of its advantages — chief amongst which are the following. On this view, propositions are unified and intrinsically truth-bearing. They are mind- and language-independent in the way required by GT and they are governed by logic. The theory of propositions is ontologically innocent. It makes room for an appropriate interface with formal semantics and it does not enforce an overly fine or overly coarse level of granularity.

Acknowledgements. For helpful comments and discussions I am grateful to: Max Cresswell, Alan Hájek and Paolo Santorio; audiences at a Centre for Time seminar at the University of Sydney on 4 June 2012, a Philosophy Department seminar at the Australian National University on 14 June 2012, and the Annual Conference of the Australasian Association for Logic on 29 June 2012; and the anonymous referees.

References

[1] Joseph Almog, John Perry, and Howard Wettstein (eds.), *Themes From Kaplan*, Oxford University Press, New York, 1989.
[2] Aristotle, *Prior Analytics*, c. 350 BC, in [3], vol. 1.
[3] Jonathan Barnes (ed.), *The Complete Works of Aristotle: The Revised Oxford Translation*, Princeton University Press, Princeton NJ, 1984.
[4] George Bealer, "A solution to Frege's puzzle", *Philosophical Perspectives*, 7 (1993): 17–60.
[5] Paul Benacerraf, "What numbers could not be", *Philosophical Review*, 74 (1965): 47–73.
[6] Paul Benacerraf, "Mathematical truth", *Journal of Philosophy*, 70, 19 (1973): 661–679.
[7] David M. Braun, "Understanding belief reports", *Philosophical Review*, 107, 4 (1998): 555–95.

[8] Rachael Briggs and Mark Jago, "Propositions and same-saying: Introduction", *Synthese*, 189, 1 (2012): 1–10. http://dx.doi.org/10.1007/s11229-012-0091-1

[9] Herman Cappelen and Josh Dever, "Believing in words", *Synthese*, 127 (2001): 279–301.

[10] Alonzo Church, "On Carnap's analysis of statements of assertion and belief", *Analysis*, 10, 5 (1950): 97–99.

[11] J. Collins, "Expressions, sentences, propositions", *Erkenntnis*, 59, 2 (2003): 233–262.

[12] M. J. Cresswell, *Structured Meanings: The Semantics of Propositional Attitudes*, MIT Press, Cambridge MA, 1985.

[13] Gareth Evans, "Understanding demonstratives", pages 280–304 in Herman Parret and Jacques Bouveresse (eds.), *Meaning and Understanding*, W. de Gruyter, Berlin, 1981.

[14] Hartry Field, *Realism, Mathematics, and Modality*, Basil Blackwell, Oxford, 1989.

[15] Hartry Field, "The normative role of logic", *Proceedings of the Aristotelian Society – Supplementary Volume*, 83, 1 (2009): 251–268.

[16] Gottlob Frege, "On sense and meaning" (1892), pages 157–177 in [18].

[17] Gottlob Frege, *The Basic Laws of Arithmetic: Exposition of the System*, University of California Press, Berkeley, 1964. Edited and translated by Montgomery Furth; originally published in German as *Grundgesetze der Arithmetik* in 1893 (volume I) and 1903 (volume II).

[18] Gottlob Frege, *Collected Papers on Mathematics, Logic, and Philosophy*, Basil Blackwell, Oxford, 1984. Edited by Brian McGuinness; translated by Max Black et al.

[19] Peter W. Hanks, "The content–force distinction", *Philosophical Studies*, 134, 2 (2007): 141–64.

[20] Peter W. Hanks, "Structured propositions as types", *Mind*, 120, 477 (2011): 11–52.

[21] Gilbert Harman, "Logical form", *Foundations of Language*, 9 (1972): 38–65.

[22] Gilbert Harman, *Change in View: Principles of Reasoning*, MIT Press, Cambridge MA, 1986.

[23] Gilbert Harman, "Field on the normative role of logic", *Proceedings of the Aristotelian Society*, 109 (2009): 333–5. http://dx.doi.org/10.1111/j.1467-9264.2009.00271.x

[24] Richard G. Heck, 'Do demonstratives have senses?" *Philosophers' Imprint*, 2, 2 (2002): 1–33.

[25] James Higginbotham, "Linguistic theory and Davidson's program in semantics", pages 29–48 in Ernest Lepore (ed.), *Truth and Interpretation: Perspectives on the Philosophy of Donald Davidson*, Blackwell, 1986.

[26] James Higginbotham, "Belief and logical form", *Mind and Language*, 6, 4 (1991): 344–369.
[27] James Higginbotham, "Remarks on the metaphysics of linguistics", *Linguistics and Philosophy*, 14, 5 (1991): 555–566.
[28] James Higginbotham, "Sententialism: The thesis that complement clauses refer to themselves", *Philosophical Issues*, 16 (2006): 101–19.
[29] Michael Jubien, "Propositions and the objects of thought", *Philosophical Studies*, 104, 1 (2001): 47–62.
[30] David Kaplan, "Demonstratives" (1977), pages 481–563 in [1].
[31] Jerrold J. Katz and Paul M. Postal, "Realism vs. conceptualism in linguistics", *Linguistics and Philosophy*, 14, 5 (1991): 515–554.
[32] Jeffrey C. King, *The Nature and Structure of Content*, Oxford University Press, 2007.
[33] Jeffrey C. King, "Questions of unity", *Proceedings of the Aristotelian Society*, 109 (2009): 257–277.
[34] Saul A. Kripke, "A puzzle about belief", pages 239–283 in A. Margalit (ed.), *Meaning and Use*, Reidel, 1979.
[35] Richard Larson and Peter Ludlow, "Interpreted logical forms", *Synthese*, 95, 3 (1993): 305–355.
[36] Richard Larson and Gabriel Segal, *Knowledge of Meaning*, MIT Press, Cambridge MA, 1995.
[37] David Lewis, "Index, context, and content", in Stig Kanger and Sven Öhman (eds.), *Philosophy and Grammar*. Reidel, Dordrecht, 1980. Reprinted in Lewis [39] 21–44; page references to latter.
[38] David Lewis, *On the Plurality of Worlds*, Basil Blackwell, Oxford, 1986.
[39] David Lewis, *Papers in Philosophical Logic*, Cambridge University Press, Cambridge, 1998.
[40] Friederike Moltmann, "Propositional attitudes without propositions", *Synthese*, 135, 1 (2003): 77–118.
[41] Friederike Moltmann, *Abstract Objects and the Semantics of Natural Language*, Oxford University Press, Oxford, 2013.
[42] Richard Montague, "Syntactical treatments of modality, with corollaries on reflexion principles and finite axiomatizability", *Acta Philosophica Fennica*, 16 (1963): 153–167.
[43] Richard Montague, "The proper treatment of quantification in ordinary English", pages 221–242 in Patrick Suppes, Julius Moravcsik, and Jaakko Hintikka (eds.), *Approaches to Natural Language*, volume 49, Dordrecht, 1973.
[44] John Perry, "Frege on demonstratives", *Philosophical Review*, 86, 4 (1977): 474–497.
[45] John Perry, "The problem of the essential indexical", *Noûs*, 13 (1979): 3–21.

[46] Brian Rabern, "Against the identification of assertoric content with compositional value", *Synthese*, 189, 1 (2012): 75–96. http://dx.doi.org/10.1007/s11229-012-0096-9

[47] Mark E. Richard, *Propositional Attitudes: An Essay on Thoughts and How We Ascribe Them*, Cambridge University Press, 1990.

[48] David Ripley, "Against structured propositions", 2012. https://sites.google.com/site/davewripley/papers

[49] Gillian K. Russell, "Metaphysical analyticity and the epistemology of logic", *Philosophical Studies*, 171, 1 (2014): 161–75. http://dx.doi.org/10.1007/s11098-013-0255-y

[50] Nathan Salmon, *Frege's Puzzle*, MIT Press, Cambridge MA, 1986.

[51] Nathan Salmon, "The very possibility of language: A sermon on the consequences of missing Church", in C. Anthony Anderson and Michael Zelëny (eds.), *Logic, Meaning and Computation: Essays in Memory of Alonzo Church*, Kluwer, 2001.

[52] Stephen Schiffer, *The Things We Mean*, Oxford University Press, 2003.

[53] Gabriel Segal, "A preference for sense and reference", *Journal of Philosophy*, 86, 2 (1989): 73–89.

[54] Nicholas J. J. Smith, "Frege's judgement stroke", *Australasian Journal of Philosophy*, 78 (2000): 153–75.

[55] Nicholas J. J. Smith, *Vagueness and Degrees of Truth*, Oxford University Press, Oxford, 2008 (paperback 2013). http://dx.doi.org/10.1093/acprof:oso/9780199233007.001.0001

[56] Nicholas J. J. Smith, "Frege's judgement stroke and the conception of logic as the study of inference not consequence", *Philosophy Compass*, 4 (2009): 639–65.

[57] Nicholas J. J. Smith, *Logic: The Laws of Truth*, Princeton University Press, Princeton, 2012.

[58] Peter Smith, "Notes on 'the contemporary conception of logic' ", August 2013. http://www.logicmatters.net/resources/pdfs/TextbooksOnLogic.pdf

[59] Scott Soames, *Beyond Rigidity: The Unfinished Semantic Agenda of "Naming and Necessity"*, Oxford University Press, Oxford, 2002.

[60] Scott Soames, *What is Meaning?*, Princeton University Press, 2010.

[61] Scott Soames, "Cognitive propositions", *Philosophical Perspectives*, 27, 1 (2013): 479–501. http://dx.doi.org/10.1111/phpe.12030

[62] Alfred Tarski, "On the concept of logical consequence", (1936), pages 409–420 in [63].

[63] Alfred Tarski, *Logic, Semantics, Metamathematics: Papers from 1923 to 1938*, Clarendon Press, Oxford, 1956. Translated by J. H. Woodger.

[64] Richmond H. Thomason, "Indirect discourse is not quotational", *Monist*, 60 (1977): 340–354.

[65] Richmond H. Thomason, "A model theory for propositional attitudes", *Linguistics and Philosophy*, 4 (1980): 47–70.
[66] Clas Weber, "Eternalism and propositional multitasking: in defence of the operator argument", *Synthese*, 189, 1 (2012): 199–219. http://dx.doi.org/10.1007/s11229-012-0092-0

Nicholas J. J. Smith
Department of Philosophy
University of Sydney
NSW 2006 Australia
njjsmith@sydney.edu.au