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Logical Form: Classical Conception and Recent Challenges

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Abstract

The term "logical form" has been called on to serve a wide range of purposes in philosophy, and it would be too ambitious to try to survey all of them in a single essay. Instead, I will focus on just one conception of logical form that has occupied a central place in the philosophy of language, and in particular in the philosophical study of linguistic meaning. This is what I will call the *classical conception* of logical form. The classical conception, as I will present it in section 1, has (either explicitly or implicitly) shaped a great deal of important philosophical work in semantic theory. But it has come under fire in recent decades, and in sections 2 and 3 I will discuss two of the recent challenges that I take to be most interesting and significant.

1. The Classical Conception of Logical Form

The classical conception of logical form brings together two strands of thought, from the theory of meaning and philosophical logic, respectively. Let me start by briefly saying something about each of these.

It is a familiar fact that the meaning of any given natural language sentence S depends, not only on the meanings of its basic constituents – the words and other basic meaningful components S contains – but also on its *semantic structure* – the way those constituents combine to form S. Hence (1) and (2) differ in truth conditions, despite sharing all the same words:

1. Homer loves Marge.

2. Marge loves Homer.

While the difference in semantic structure between (1) and (2) is readily apparent, overt word order is not always a straightforward guide to semantic structure. One way to see this is to consider certain cases of ambiguity:

3. Lecturing philosophers can be exasperating.

On one reading, (3) means that it can be exasperating to be subjected to lecturing philosophers, but on another reading it means that the task of lecturing philosophers can be an exasperating one. The availability of the two readings is due to the fact that two distinct semantic structures are compatible with the overt word order in (3).

Moreover, even when there are differences in overt word order it is not always clear what difference in semantic structure this reflects. For example, consider:

4. Lisa reluctantly instructed Bart.

5. Bart was reluctantly instructed by Lisa.

(4) says that Lisa was reluctant to instruct Bart, but (5) is ambiguous: it can be understood as attributing reluctance either to Lisa or to Bart. It is no easy task to uncover the underlying structural differences that account for this difference between (4) and (5), especially in light of the fact that the adverb-free analogues of (4) and (5) – "Lisa instructed Bart" and "Bart was instructed by Lisa" – are equivalent. (See McConnell-Ginet 1982 for a useful discussion of some of the difficulties.) A central challenge for the theory of meaning, therefore, is to uncover the semantic structures of sentences and to systematically describe the contributions these structures make to meaning.

Facts about the meanings of sentences are closely tied to facts about entailment relations among sentences. It is commonly assumed that, in the course of describing the contribution of semantic structure to meaning, an adequate theory of meaning will also account for the fact that certain sentences entail certain others. For example, consider the following:

6. Lisa quickly left.

7. Lisa left.

(6) obviously entails (7); necessarily, if (6) is true then so is (7). Notice, moreover, that this entailment is an instance of a more general pattern: in addition to (6), "Lisa slowly left," "Lisa quietly left," "Lisa angrily left," and many other sentences also entail (7). These cases contrast with entailments such as the one from "Moe is a bachelor" to "Moe is male" or from "Bart is Lisa's brother" to "Bart is Lisa's sibling," which intuitively depend on the specific meanings of words. All that seems to matter for the validity of the entailment from (6) to (7) is the adverbial structure in (6) and its relation to the unmodified (7). Hence this entailment is an example of what is often called *structural entailment*, since its validity seems to depend only on the semantic structures of the sentences involved. Here are more paradigm examples of structural entailment:

8. Bart broke the window; so the window broke.

9. Homer ate pork chops; so pork chops were eaten.

10. Some boy likes Lisa; so some boy is a boy who likes Lisa.

(8), too, is an instance of a more general pattern, one that includes "Nelson blew up the school; so the school blew up"; "Lisa grew a tree; so a tree grew"; "Marge boiled the water; so the water boiled"; and many others. And along with (10) we have "Every girl admires Lisa; so every girl is a girl who admires Lisa," "No men bowled with Homer; so no men are men who bowled with Homer," and so on. It is standard practice among theorists of meaning to expect that an adequate account of semantic structure should also account for the validity of structural entailment patterns like these.

But what, precisely, does it mean to account for the validity of structural entailment patterns? What would such an account look like? It is at this point that the second strand of the classical conception of logical form becomes relevant. According to a venerable picture of philosophical logic, the job of the logician is to study the properties of arguments whose validity depends only on the forms of sentences, rather than on their content or subject-matter. On this picture both of the following arguments are in the logician's domain:

11. Homer danced and Marge laughed.
    Therefore, Homer danced.

12. If Homer danced then Marge laughed.
    Homer danced.
    Therefore, Marge laughed.

According to the venerable picture, (11) and (12) are of interest to the logician because they are both *valid in virtue of logical form* (or *logically valid*, for short). (11) is valid in virtue of logical form because its premise is an instance of the form $\ulcorner P\&Q \urcorner$ – it is constructed by conjoining two sentences with "&" – and every sentence of the form $\ulcorner P\&Q \urcorner$ entails the corresponding P. Similarly, (12) is valid in virtue of logical form because its first premise is of the form $\ulcorner P \supset Q \urcorner$, and any premise of this form, along with P, entails Q. By contrast, the following argument is not valid in virtue of logical form:

13. Moe is a bachelor.
    Therefore, Moe is male.

From a logical point of view this argument is simply of the form $\ulcorner$P; therefore Q$\urcorner$ (or perhaps better, $\ulcorner$B(m); therefore M(m)$\urcorner$) and not all arguments of that form are valid. The logician studies arguments like (11) and (12), and not arguments like (13), because the logician is interested in arguments that are valid in virtue of their logical form; their validity depends only on the way the premises and conclusion are constructed from a basic stock of non-logical expressions using a small class of logical expressions like "&," "⊃," and "¬."

The classical conception of logical form proposes to bring together the semanticist's interest in semantic structure and the logician's interest in logical form. According to the classical conception, semantic structure *just is* logical form. That is, the structure whose semantic role the theorist of meaning seeks to describe is one and the same thing as the logical form in terms of which the logician classifies arguments as logically valid or not. According to the classical conception, it is the logical form of a sentence that, in conjunction with the meanings of its non-logical elements, determines its meaning. And uncovering the logical forms of sentences reveals structural entailment patterns to be logically valid, valid in virtue of the logical forms of the sentences involved.

We can illustrate the classical conception with an example from Donald Davidson, one of its most influential proponents.[1] However, the classical conception is independent of Davidson's particular views about the nature of linguistic meaning. Consider sentence (7) again. Davidson (1980) proposes that the verb "leave" functions in the logical form of (7) as a two-place predicate relating an object (intuitively, the one who leaves) to an event (intuitively, an event of leaving). In the logical form of (7) "Lisa" occupies one argument-place, and the event argument-place is bound by an existential quantifier. So according to Davidson, the logical form for (7) is given as follows:

7L. ∃eLeave(e,lisa).

(I will ignore tense throughout.) What (7L) says is that there is an event that is a leaving by Lisa. Once we admit quantification over events into logical form, we can use the added resources to give an account of adverbially modified sentences. Davidson suggests that adverbs like "quickly" should be treated as predicates of events. The logical form assigned to (6) is given as follows:

6L. ∃e[Leave(e,lisa) & Quick(e)]

(6L) says that there is an event that is both a leaving by Lisa and is quick. (See Parsons 1990 for an extensive development of the Davidsonian event-based approach to logical form.) According to Davidson it is partly because the logical forms of (6) and (7) are as given in (6L) and (7L) that (6) and (7) mean what they do. That is, in order to understand the contribution to the meanings of (6) and (7) made by their semantic structures, we need to see them as really – in a sense of "really" that still needs to be made clear – being built up out of non-logical vocabulary using the logical constants "∃" and "&" in the ways indicated in (6L) and (7L). Moreover, notice that the argument from (6L) to (7L) is logically valid. So by assigning the logical forms of (6L) and (7L) as the semantic structures of (6) and (7), the classical conception treats the structural entailment from (6) to (7) as one that is valid purely in virtue of their logical forms.[2]

Before turning to challenges to the classical conception, three related points of clarification are in order. First, the classical conception as presented here is, in Jason Stanley's (2000) terms, a *descriptive* rather than a *revisionary* conception of logical form. According to a revisionary conception, natural language is somehow inadequate for the purposes of rigorous inquiry in science or mathematics, and claims about logical form are understood as claims about how natural language should be replaced with a notation that better suits the needs of such inquiry. But the claims about logical form just surveyed are descriptive rather than revisionary: they are meant to be taken as claims about the real, "underlying" semantically relevant structures of (6) and (7), not recommendations about how to replace (6) and (7) in an ideal scientific language. The classical conception therefore has the burden of explicating the sense in which sentences like (6) and (7) really have the logical forms of formulas like (6L) and (7L).

Second, however, the obvious fact that, for example, sentence (7) does not contain a conjunction or an existential quantifier among its explicitly pronounced constituents does not immediately show that the classical conception cannot meet this burden. If the classical conception is correct then the logical forms of sentences cannot be directly "read off" of their overt forms, and many sentences will turn out to have non-obvious logical forms. But as we saw above, this appears to be an inevitable fact about semantic structure, whether or not we identify semantic structure with logical form.

Third, and finally, advocates of the classical conception need not be committed to the claim that logical forms like (6L) and (7L) correspond to any level of syntactic description of (6) and (7). In particular, they need not be committed to claiming that (6L) and (7L) correspond to the Logical Forms (LFs) of (6) and (7), as that notion is employed in current syntactic theory. (This is another of the many uses of the overworked term "logical form.") LF is called upon in syntactic theory to play a very different sort of explanatory role than logical form in the present sense, and advocates of the classical conception need not claim that the two notions will converge. (For discussion of LF in syntactic theory, see Chomsky 1995 and May 1985.)

These last two points do not, however, absolve the classical conception of its need to justify its claims; it must offer some way of making sense of the claim that, for example, (6L) really is the logical form of (6). We'll see what sense can be made of it in the next section, as we turn to the first of the two challenges to be discussed.

2. The First Challenge

What does it mean to claim that some formula is the logical form of a natural language sentence? Focusing on our example from Davidson, what does it mean to say that (6L) is the logical form of (6)? (6) and (6L) are clearly equivalent (at least, if we put aside metaphysical qualms about the existence of events) and so there is a sense in which (6L) is a perfectly good paraphrase of (6). But remember, the classical conception of logical form is meant to be descriptive rather than normative. The mere fact that we *can* paraphrase

(6) as (6L) doesn't yet show that there is any robust sense in which the semantic structure of (6) really is given by (6L).

A customary answer to this question is given by what we might call the *two-stage approach* to the theory of meaning. The two-stage approach divides the task of devising a theory of meaning into two steps. In the first step we specify a systematic mapping of natural language sentences into formulas of some canonical formal language.[3] Then in the second step we develop a semantic theory for the formulas of the canonical language, such as a model-theoretic semantics or a Tarski-style theory of truth-conditions. The meanings of the sentences of the original language are thereby given indirectly, via the meanings assigned to their formal-language correlates. (For classic presentations of the two-stage approach see Davidson 1984, Dowty *et al.* 1981 and Parsons 1990.) Within the context of the two-stage approach, we can regard the claim that (6L) is the logical form of (6) as the claim that an adequate two-stage semantic theory must map (6) onto (6L) in order to correctly specify the meaning of (6). Let's call such a mapping an *interpretive mapping*. More generally, to say that some formula F is the logical form of a sentence S is to say that F is the correlate that must be assigned to S by any interpretive mapping.

Supplemented with the two-stage approach to the theory of meaning, the classical conception of logical form yields the following picture. The semantic structure of a sentence S is its logical form, and the logical form of S is given by the formula F that S must be mapped onto by an adequate two-stage theory of meaning. Moreover, the mapping will reveal that structural entailments like the ones surveyed above are valid in virtue of logical form, in the sense that whenever S structurally entails S′, the formal language correlates F and F′ of S and S′ will be such that the inference from F to F′ is logically valid. According to the classical conception, then, an adequate two-stage semantic theory simultaneously reveals the semantic structures of natural language sentences and also shows that structural entailments are simply non-obvious cases of logical validity.

This is an attractive picture. But notice that it assumes that the two-stage approach yields such a thing as *the* logical form for any given sentence – that is, it assumes that there is a unique interpretive mapping of sentences onto logical forms. Moreover, the classical conception requires that this unique interpretive mapping assigns sentences the kinds of logical forms needed in order to render structural entailments valid in virtue of logical form. The first of our two challenges to the classical conception questions both of these assumptions.

For starters, the assumption of a unique interpretive mapping appears to be unwarranted. For example, on Davidson's proposal (14) has the logical form given in (14L):

14. Brutus stabbed Caesar.

14L. ∃eStabbing(e,brutus,caesar)

It is plausible that a theory that maps (14) onto (14L) will yield the right meaning for (14). But we might instead follow Quine's (1984) suggestion of adopting a formal language that eliminates proper names in favor of predicates, which would yield the following alternative logical form for (14):

14L'. ∃e∃x∃y[Brutizes(x) & Caesarifies(y) & Stabbing(e,x,y)]

(Here "Brutizes" is a predicate that applies to an object just in case that object is identical with Brutus, and "Caesarifies" is a predicate that applies to an object just in case that object is identical with Caesar.) (14L′) seems to do just as good a job as (14L) of specifying the meaning of (14). One might be tempted to object that (14L′) misrepresents the semantic structure of (14), because it treats "Brutus" and "Caesar" as predicates rather than as arguments. But this objection is not available to the classical theorist – on her view, the semantic structure of (14) *just is* its logical form, and so she needs some independent grounds for ruling out (14L′) as an interpretive mapping of (14). And while it's true that (14L′) treats (14) as having logical structure that is not apparent in its overt form, so does (14L). So it's difficult to see how we could justify ruling out one but not the other as non-interpretive. Or consider another example:

15. Every student is smart.

The standard logic-class mapping for (15) is as follows:

15L. ∀x[Student(x) ⊃ Smart(x)]

But we might just as well map (15) onto a formula that uses restricted-quantifier notation instead:

15L'. [Every x: Student(x)](Smart(x))

(15L′) says that every x such that x is a student is smart. On the classical conception, these two mappings amount to different claims about semantic structure: a two-stage theory that maps (15) onto (15L) treats (15) as a material conditional; a theory that maps it onto (15L′) does not. And yet it's extremely difficult to see how one could plausibly maintain that one, but not the other of these theories provides an interpretive mapping for (15). The classical conception's assumption that there is a unique interpretive mapping for every sentence therefore seems unjustified.

As Gareth Evans (1976) points out, the availability of multiple interpretive mappings also challenges the classical conception's treatment of structural entailments as valid in virtue of logical form. For example, consider the following structural entailment:

16. Bart found a unicorn; so there is a unicorn Bart found.

(16) is valid, as are analogues of (16) containing most other transitive verbs in place of "find." It is not difficult to find an interpretive mapping that

renders (16) valid in virtue of logical form. But compare (16) to the following, which is invalid:

17. Bart sought a unicorn; so there is a unicorn Bart sought.

It's not immediately obvious how best to represent (17) in terms of logical form. But the classical conception is committed to there being *some* way to do so. Provided that this is so, there is nothing to stop us from providing the same sort of mapping for "Bart sought a unicorn" and "Bart found a unicorn." (This is, in fact, the treatment given in Montague 1973; see also Dowty *et al.* 1981.) Such a mapping cannot classify (16) as valid in virtue of logical form, on pain of incorrectly treating (17) as valid. So even though we *can* treat (16) as valid in virtue of logical form, the classical conception is also committed to the possibility of another interpretive mapping for (16) that does not render it valid in virtue of logical form. Thus the possibility of multiple interpretive mappings poses a problem for the classical conception's identification of structural entailments with entailments that are valid in virtue of logical form. (See Evans 1976 and Jackson (forthcoming) for more examples that illustrate this point.)

The challenge for the classical conception that these observations raise is as follows: (i) to find some basis for making determinate unique assignments of logical forms to sentences; and (ii) to do so in such a way that structural entailments turn out to be valid in virtue of logical form. There are options for achieving (i) that are worth exploring. First, one might look for further constraints to impose on mappings, over and above the constraint of providing an accurate characterization of the meanings of sentences. For example, Richard Larson and Gabriel Segal (1995) adopt a psychologistic conception of logical form that, in effect, treats proposed mappings as competing psychological hypotheses about the representations that the human language faculty assigns to sentences. Alternatively, it may be possible to define logical form in terms of some abstract property shared by the various possible interpretive mappings provided within the two-stage framework. Such an account of logical form would allow the classical theorist to maintain, for example, that both a theory that maps (15) onto (15L) and one that maps it onto (15L′) treat it as having the same logical form. Ernie Lepore and Kirk Ludwig (2002) propose a theory of logical form along these lines.

Both of these options, and no doubt others, are worth exploring. But if either is to help the classical conception, they must help achieve (ii) as well; that is, they must vindicate the identification of structural entailment with entailments that are logically valid. It is far from obvious that they can do so. Logical form as Lepore and Ludwig conceive of it is rather far removed from the logician's notion of logical validity that the classical conception employs; for example, their view is likely to entail that instances of ⌜P&Q⌝ and ⌜P or Q⌝ have the same logical form. And Larson and Segal explicitly abandon the classical theorist's claim that structural entailments are valid in virtue of logical form as they conceive of it. (See Jackson (forthcoming) for discussion of Larson and Segal's view.)

The first challenge certainly doesn't show that the two-stage approach to the theory of meaning is fundamentally misguided, or that logical form has no role to play within the theory of meaning. (In the concluding section I'll have a bit more to say about what role logical form might play.) What it does question, however, is whether any deep or illuminating connections are to be found between the logician's notion of logical form and the issues concerning semantic structure that are of interest to the semanticist.

3. The Second Challenge

The arguments of the previous section raise problems for the classical conception based on considerations from the theory of meaning; they challenge the claim that semantic theory will reveal important connections with formal logic. In this section I want to put aside the concerns of the previous section and consider a challenge that arises from the other direction, based on considerations from the philosophy of logic.

As we saw above, the notion of validity in virtue of logical form is characterized in terms of a distinguished set of logical constants such as "&," "$\vee$," "$\neg$," and "$\exists$." For example, consider the following argument:

18. Marge is tall or Homer is short.
    Marge isn't tall.
    Therefore, Homer is short.

The logician regards (18) as logically valid because it can be construed as an instance of the following schema, all of whose instances are valid:

19. $P \vee Q$
    $\neg P$
    Therefore, Q.

All that matters for the validity of (18) is that it is constructed in the way indicated in (19), using the logical constants "$\vee$" and "$\neg$"; the non-logical vocabulary in (18) is inessential. Which arguments we count as valid in virtue of logical form clearly depends on which expressions we classify as logical constants. For example, while the following argument is certainly valid, it is not customarily regarded as valid in virtue of logical form:

20. Snowball is white.
    Therefore, Snowball is colored.

This is because the words "white" and "colored" are not customarily classified as logical constants. If "white" and "colored" were included among the logical constants, then (20) *would* count as logically valid, since it is an instance of the schema:

21. White(n)
    Therefore, Colored(n).

which is valid no matter what name we put in place of "n." In order to know which arguments count as logically valid, then, we need to know which expressions count as logical constants.

For most day-to-day purposes a simple list of logical constants suffices. But if the notion of logical validity is to be more than a matter of arbitrary stipulation we need an answer to what I'll call the *demarcation question*: on what basis does any given expression count, or fail to count, as a logical constant?

The classical conception cannot regard the notion of logical validity as a matter of arbitrary stipulation, since it hopes to make sense of the contrast between structural and lexical entailment as the contrast between arguments that are valid solely in virtue of their logical form and those whose validity depends on the specific content or subject-matter of sentences. The classical conception is therefore committed to there being some answer to the demarcation question. Moreover, the classical conception is committed to an answer that yields a fairly traditional set of logical constants. It won't do for "white" and "colored" to be classified as logical constants, for example, since that would render the lexical entailment in (20) valid in virtue of logical form. More generally, since the classical conception hopes to analyze structural entailment in terms of logical validity, the right answer needs to be such that the distinction between logical and non-logical constants "tracks" the structural/lexical distinction – it needs to make plausible the thought that logical validity really is a matter of structure rather than lexical meaning.

The second of our two challenges to the classical conception raises doubts as to whether there is a plausible answer to the demarcation question that meets these criteria. There *is* a traditional view of the logical constants, which I'll call the *grammatical particle* theory, that is ideally suited to the needs of the classical conception. But the grammatical particle theory is deeply problematic. Moreover, recent work in the philosophy of logic suggests that no answer to the demarcation question meeting the needs of the classical conception is likely to be forthcoming.

According to the grammatical particle theory, the traditional logical constants – such as the connectives and quantifiers of first-order logic – count as such because they are mere devices for indicating various sorts of syntactic constructions, rather than meaningful lexical items in their own right. For example, the grammatical particle theory regards the difference between the sentences in (22) as a difference in which meaningful words they contain, but it regards the sentences in (23) as differing only in syntactic structure:

22. Snowball is white.
    Snowball is black.

23. Marge is tall and Homer is short.
    Marge is tall or Homer is short.

According to the grammatical particle theory, the sentences in (23) contain all the same meaningful lexical items; "and" and "or" serve merely to signal a difference in syntactic structure. Bertrand Russell (1920) endorses the grammatical particle view when he says that, "it is one of the marks of a proposition of logic that, given a suitable language, such a proposition can be asserted in such a language by a person who knows the syntax *without knowing a single word of the vocabulary*" (p. 201; italics added). The implication here is that the logical constants are to be counted as part of the syntax of the language rather than as part of the vocabulary. In a similar vein, Quine (1970) classifies the logical constants as "particles" along with such bits of syntax as parentheses and accent markers on variables, which are to be distinguished from the meaningful vocabulary of the "lexicon." If logical constants are mere grammatical particles, then logically valid arguments such as (18) depend only on the syntactic structures of sentences; their validity is entirely independent of the meaningful words they contain. On this view the distinction between logical and non-logical constants tracks the structural/lexical distinction quite directly, and it makes plausible the classical conception's claim that structural entailment patterns are simply non-obvious cases of logical validity.

The problem with the grammatical particle theory, however, is that it is just not plausible that the traditional logical constants don't count as meaningful parts of the English vocabulary. Intuitively the "and" in "Marge is tall and Homer is short" is a meaningful word, one that has distinctive inferential properties that it doesn't share with other words such as "or" that play the same syntactic role. Indeed, it is widely believed that the inferential properties distinctive of "and" (or perhaps a privileged subset of them) are what *constitute* or *determine* its meaning (Boghossian 1996, Hodes 2004 and Peacocke 1992). It's true that in typical formal languages the logical constants are not included in the basic vocabulary along with singular terms, function constants and predicates. Instead the logical constants are typically introduced in the course of specifying the well-formed formulas of the language. But there is nothing obligatory about this treatment, and, as John MacFarlane (2005) notes, there is little reason to think that empirical research in English syntax will reveal that it accurately reflects the facts of English. The prospects for the grammatical particle theory are dim, and the classical theorist is well-advised to look elsewhere for the answer to the demarcation question that she needs.

However, recent authors who endorse what I'll call a *pragmatist* view of the logical constants argue that no such answer is forthcoming. Pragmatists accept a traditional list of logical constants, but not on the basis of any philosophically substantial answer to the demarcation question. The pragmatists see the traditional logical constants as simply those expressions that happen to yield a notion of logical validity that is useful for certain purposes. According to Ken Warmbrōd (1999), for example, the standard connectives and first-order quantifiers count as logical constants because they provide a notion of logical validity that is useful for deductively systematizing scientific theories – they provide an efficient tool for clarifying which claims are made by a theory and for systematically testing it. Mario Gómez-Torrente (2002) agrees that the role of logic in deductively systematizing scientific theories is relevant to the choice of logical constants. But he takes a somewhat broader perspective, arguing that logic is concerned with the general task of evaluating arguments as correct or incorrect, and so "should deal with expressions usable in and relevant to general reasoning, expressions not specific to any of the spheres where argument is employed but common to all or a great number of them" (p. 3).

Pragmatists typically support their view by arguing that attempts to answer the demarcation question in more philosophically robust terms – e.g. by appeal to grammatical criteria like the one sketched above, or in terms of topic-neutrality or permutation-invariance – fail to demarcate the traditional list. I won't canvas those arguments here; see MacFarlane (2005) for an excellent survey. What's important to note for present purposes is that if the pragmatists are right then there is little reason to think that logical validity has anything at all to do with validity in virtue of structure. Logically valid arguments are simply arguments whose validity is guaranteed by the meanings of words that happen to be useful for the purposes of systematizing scientific theories, or that happen to be employed in a broad range of areas where arguments are used and evaluated. Contrary to the classical conception, validity in virtue of logical form therefore falls on the lexical side of the structural/lexical distinction, and so can't capture what is distinctive about structural entailment.

4. Concluding Remarks

I described the arguments of the previous sections as challenges, since they are just that: challenges for the classical conception to provide a conception of logical validity that vindicates the traditional idea that logic is the study of arguments that are valid purely in virtue of their structure, and to show that logic, so conceived, plays a central role in describing the semantic structures that concern natural language semanticists. It remains an open question whether these challenges can be met. My own view, however, is that the chances of this are slight, and so I'll conclude with a very brief sketch of an alternative way of thinking of semantic structure and logical form.

On this alternative view, the semantic structure of a sentence is simply its syntactic structure. That is, the structure that helps determine the meaning of a sentence is whatever structure it is revealed to have by detailed empirical investigation into the syntax of the language. The observations in Section 1, about the ways in which semantic structure can be difficult to discern from overt word-order, are compatible with a view that identifies semantic and syntactic structure. Syntactic theorists are long accustomed to the idea that the overt word-order of a sentence is not an infallible guide to its syntactic structure, and on most current theories overt word-order is just the tip of the syntactic iceberg (see Radford 2004).

Empirical syntax is an unsettled and quickly developing science, however, and so there is at least a heuristic role for logical form to play. By saying that a given formula F is the logical form of a given sentence S we can capture certain semantically relevant features of S that are given a perspicuous representation by means of F, while remaining neutral among competing syntactic analyses. These features include S's truth conditions, the number of arguments and their relations to the verbs or other argument-taking elements in S, the relative scopes of quantifiers in S (if any), and structural entailment relations that S bears to other sentences. With its simple syntax, familiar customary interpretation, and well-understood logic the predicate calculus provides a useful medium in which to represent these features. If logical form is given this purely heuristic role then there is no need to make sense of the idea that the semantic structure of a sentence is, in some deep sense, "really" its logical form, nor is there any need to defend a conception of logic according to which logical validity is purely a matter of structure. The heuristic conception of logical form therefore avoids the worries that dog the classical conception.

Notes

[1] On Davidson's view the meaning of a sentence is given by a canonical specification of its truth conditions; see Davidson 1984.

[2] In what follows I will sometimes speak as if formulas like (6L) and (7L) are themselves logical forms, e.g. by saying that (6L) is the logical form of (6). But strictly speaking, logical forms are not formulas; they are templates for building formulas, specified in terms of the logical constants they contain. The claim that, e.g., (6L) is the logical form of (6) should be understood as a convenient shorthand for the claim that (6) is really an instance of the logical template made explicit in (6L).

[3] Classical theorists such as Davidson and Parsons choose the language of first-order predicate logic. But this is not obligatory; for example, following Richard Montague (1973) one might employ a higher-order intensional logic. One's choice of canonical languages turns, in part, on the question of what distinguishes logical from non-logical constants; this is a question we'll turn to in Section 3.

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