

Obligation and aspect

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Contents

1	A puzzle about obligation and aspect	5
1.1	The Obligation–Aspect Effect	5
1.2	A contextual-pragmatic effect?	9
1.3	A performative effect?	11
1.4	A semantic effect	16
1.4.1	Repair Compositionality	16
1.4.2	A proposal for semantic typing	18
1.4.3	Explaining the Obligation–Aspect Effect	20
2	The uninflected clause	23
2.1	Motivation	25
2.1.1	Rationalization of action	25
2.1.2	Practical contents	27
2.1.3	Practical attitudes	29
2.1.4	Advantages	32
2.2	Motivation and command	34
2.2.1	Terminology	35
2.2.2	Social procedures	36
2.2.3	The aim of command	37
2.3	Command and imperative sentence	39
2.3.1	A pragmatic basis for semantics	39
2.3.2	Imperative entailment?	41
2.3.3	Imperatives, declaratives, and connectives	44
2.4	Imperative sentence and uninflected clause	45

3	Temporal perspective	47
3.1	The RSTU theory	47
3.1.1	R, S, and T	49
3.1.2	Type-lowering	50
3.1.3	Predictions	51
3.2	Favorable phenomena	52
3.2.1	Perfective progressive	52
3.2.2	Progressive	52
3.2.3	Perfective	54
4	Modals	56
4.1	Logic and ratification	57
4.1.1	First principles	57
4.1.2	Ratification as truth	58
4.1.3	Ratification as support	59
4.2	Modals as intensional operators	60
4.3	Against truth	64
4.4	Finishing up	66

Although imperative sentences can be used in many ways—to offer, to advise, to suggest, to beseech—their canonical use is in *command*. On *obligative* uses of ‘must’, a sentence containing ‘must’ is surprisingly close in meaning to an appropriately-matched canonical imperative—for example, the pair ‘Fred must open the door.’ and ‘Fred open the door!’. This similarity cuts across a number of dimensions.

First. One who endorses the imperative sentence (perhaps because they have just used it (or are about to use it) to issue a command, or embraced someone else’s use of that sentence to issue a command, or because they are Fred and have just accepted the command) seems hard-pressed to avoid accepting the obligative ‘must’-sentence. And in the main, one who accepts the obligative ‘must’-sentence can scarcely avoid endorsing the command: it is certainly possible to alienate oneself from the command situation while still recognizing that a command has been given; but this involves a sort of cognitive sophistication we might reasonably set aside until the fundamentals are understood—and Fred himself, if he accepts an assertion of the obligative sentence, would react in much the same way as if he had accepted an assertion of the command.

Second. One who endorses ‘Fred open the door!’ typically will not endorse ‘Fred open the door or drink up all my wine!’: disjunction-introduction fails for imperatives, even though disjunction-elimination, conjunction-introduction, and conjunction-elimination appear to be more compelling—this is the famous ‘Ross paradox’.¹ Obligative ‘must’ behaves similarly: one who endorses ‘Fred must open the door.’ typically will not endorse ‘Fred must open the door or drink up all my wine.’—though, perplexingly, ‘Either Fred must open the door or Fred must drink up all my wine.’ can seem harder to resist.

Third. Contrast ‘Fred must open the door’ with ‘Fred must (be opening/have opened/have been opening) the door’: the first is obligative, the second group clearly aren’t. Without aspect, ‘must’ wants to be obligative; introduce aspect, and any obligatory meaning evaporates. This *Obligation–Aspect Effect* is striking, but bizarre. Aspect is about the temporal point of view we take on events. But what should *that* have to do with our obligations? —But note that imperatives cannot be laden with aspect: *‘Fred have opened/be opening/have been opening the door!’ are all ungrammatical.

¹Ross, ‘Imperatives and logic’.

I contend that the link between imperatives and obligative modals is more than superficial. The obligative ‘Fred must open the door.’ is just the action of ‘must’ on the imperative ‘Fred open the door!’: more generally, *an obligative-modal sentence is a modalized imperative*. Although the content of the imperative is a *procedure*—an entity nothing like a proposition—this is unproblematic: against contemporary ‘orthodoxy’,² modals quantify not over worlds, but over mental states.

This article assembles resources for an explanation of the Obligation–Aspect Effect. Section 1 develops the puzzle it raises, criticizes extant approaches to the puzzle, and outlines the explanation I will develop over the remainder of the article. Section 2 defends a nonpropositional theory of imperative content: I equate the (context-relative) content of an imperative with the contents of the commands it is used to make; argue that commands put on display practical mental states of social agents; and sketch up an Anscombesque theory of practical reason on which the content at issue is a procedure. Section 3 explains how introducing aspect screens off any higher operators from that procedural content. Section 4 argues that ‘must’ quantifies over mental states, and that modals are more generally ‘perspectival’, pertaining to our understanding of ourselves and others. In the background is a conception of meaning as normative, formal, representational, and social—but primarily psychological.

The Obligation–Aspect Effect, on my story, is the product of a number of components of natural language meaning: imperatival syntax and semantics in relation to declarative syntax and semantics, temporal perspective, modality, composition. Each of these components has its own intricacies, and is itself well-studied. In light of this complexity, the discussion is unavoidably programmatic, despite the considerable length of the article.

So why bother reading it? As I discuss in section 1.2, the Obligation–Aspect Effect exposes the limitations of contemporary orthodoxy regarding modals. A treatment of the Obligation–Aspect Effect modestly extending the orthodoxy³ has gained considerable traction.⁴ But as I will discuss in section 1.3, this treat-

²Kratzer, ‘Notional category’.

³Ninan, ‘Two puzzles’.

⁴Portner, ‘Imperatives and modals’; Hacquard, *Aspects of Modality*; Hacquard, ‘Aspect and modals’.

ment itself faces troubling questions. I draw the conclusion that to explain the Obligation–Aspect Effect, it is not enough to extend the contemporary modal orthodoxy: instead, modals should be fundamentally reconceptualized as having a ‘perspectival’ meaning, along the lines discussed in section 4.

The remainder of the story connects this fundamental reconceptualization to the data, the Obligation–Aspect Effect. Throughout, the elemental components gathered in the story are ‘off-the-shelf’: such novelty as there may be involves the arrangement of the assembled components, rather than any conjuration *ex nihilo*. And I have attempted also to minimize the potential energy trapped in the system, by striving for a relatively natural continuity of spirit among the components.

On the whole, then, my aim is for this article to provide a sort of ‘proof of concept’: an illustration of a potential application of the perspectival conception of modals, with enough detail sketched in that flaws, merits, or further avenues of investigation may become apparent.

1 A puzzle about obligation and aspect

1.1 The Obligation–Aspect Effect

An obligative use of ‘must’ is on display in (1):

1. Fred must open the door.⁵

On what is by far its most natural reading, (1) conveys the sense that Fred is in some way under an obligation to open the door.

But when *aspect* is introduced within the scope of ‘must’, as in (2), the prospect of an obligative reading vanishes:

2. (a) Fred must be opening the door.
(b) Fred must have opened the door.

⁵In displayed examples, *sentences* are distinguished from *constituents* by the presence of concluding punctuation in the former and its absence in the latter. Declarative sentences are represented with a concluding period, while imperative sentences are represented with a concluding exclamation mark.

- (c) Fred must have been opening the door.

The most natural readings of (2) are *epistemic*: they convey a sense of confidence that Fred either is opening the door, has opened the door, or has been opening the door.

Other readings are available. An epistemic reading of (1) can be forced: in answer to ‘Fred hears the knock at the door: what happens then?’, (1) expresses a sense of confidence that Fred then opens the door; in answer to ‘who do you think opens the door around here?’, (1) expresses a sense of confidence that Fred generally opens the door around there. And the (2) can perhaps be used to state that Fred is under some psychological compulsion.

Further complications: when embedded under temporal adverbials, the (2) can regain their obligative force. Replace the action at hand with something a bit longer-lasting—*cooking dinner*, say—and preface each with ‘by the time I get back’, and the results are as in (3):

3. (a) By the time I get back, Fred must be cooking dinner.
(b) By the time I get back, Fred must have cooked dinner.
(c) By the time I get back, Fred must have been cooking dinner.

Despite this range of flexibility, (1) and (2) still contrast starkly:

(OA) The Obligation–Aspect Effect

- (i) The obligative deontic reading of (1) is very strongly preferred; but
(ii) A deontic reading of (2) is only possible when embedded, as in (3).

This Obligation–Aspect Effect is invariant under the choice of aspect: whether what is introduced is the ‘progressive’, as in (2a); or the ‘perfective’, as in (2b); or both, as in (2c).

The Obligation–Aspect Effect is hard to make sense of. For it may appear that the strongly preferred deontic reading of (1) is ‘turned off’ in (2) just by introducing an aspectual morphological complex within the scope of ‘must’. On a straightforward compositionality principle, no operator can change the interpretation of any operator outside of its scope. But given plausible hypotheses about

the syntax of (1) and (2), the Obligation–Aspect Effect would seem to require just that: aspect ‘reaching outside’ of its scope to ‘tweak’ the interpretation of the modal.

If that is not possible, the Obligation–Aspect Effect cannot be a semantic effect, but instead must stem from something ‘Gricean’: general social strategy, obvious common sense, or what not. But to my mind, the effect is too drastic, too robust, to stem from such weak explanantes. Something higher-powered must be wheeled in.

Let me run in more detail through the argument two paragraphs back. I have the following syntax in mind. Compare (1) and (2) with (4) and (5):

4. Fred opens/opened the door.
5. (a) Fred is/was opening the door.
(b) Fred has/had opened the door.
(c) Fred has/had been opening the door.

It is *prima facie* plausible that the sentences result from the application to the nonfinite clauses in (6) and (7) of a tense-bearing expression:

6. Fred open the door
7. (a) Fred be opening the door
(b) Fred have opened the door
(c) Fred have been opening the door

Specifically, for (1) and (2), the tense-bearing expression is the past-tense modal ‘must’; whereas for (4) and (5), the tense-bearing expressions are the present/past-tense morphemes.

If so, the logical forms of the sentences and nonfinite clauses in (1)–(7) are as in (1-LF)–(7-LF):⁶

⁶Why believe it? First, by my understanding, it is generally agreed among syntacticians that tense is the highest element in the inflectional stack, superceding any aspectual elements. Second, by my understanding, modal auxiliaries are generally agreed to be bearers of tense. Third, by my understanding, a sentence has exactly one occurrence of tense (setting aside embeddings under

(1-LF) $\Box(\text{Open}(f))$

(2-LF) (a) $\Box(\text{prog}(\text{Open}(f)))$

(b) $\Box(\text{perf}(\text{Open}(f)))$

(c) $\Box(\text{perf prog}(\text{Open}(f)))$

(4-LF) $\text{PRES}(\text{Open}(f))/\text{PAST}(\text{Open}(f))$

(5-LF) (a) $\text{PRES}(\text{prog}(\text{Open}(f)))/\text{PAST}(\text{prog}(\text{Open}(f)))$

(b) $\text{PRES}(\text{perf}(\text{Open}(f)))/\text{PAST}(\text{perf}(\text{Open}(f)))$

(c) $\text{PRES}(\text{perf prog}(\text{Open}(f)))/\text{PAST}(\text{perf prog}(\text{Open}(f)))$

(6-LF) $\text{Open}(f)$

(7-LF) (a) $\text{prog}(\text{Open}(f))$

(b) $\text{perf}(\text{Open}(f))$

(c) $\text{perf prog}(\text{Open}(f))$

These logical forms represent (6) as the most basic clause among our examples, present in the syntax of all others. The other nonfinite clauses in (7) result from applying either or both of the English aspectual complexes to (6); the sentences in (1)–(5), finally, result from applying either tense or modality to one of the nonfinite clauses.

Let $\llbracket \xi \rrbracket$ abbreviate ‘the semantic value of the logical-form expression ξ ’. Then consider the following compositionality principle, according to which semantic composition isomorphizes logical form-syntactic composition:⁹

psych verbs, conjunctions, and the like). Fourth, I note that the perfective ‘captures’ tense from the progressive when both are present, and that when either is present, tense is ‘captured’ from the action verb. Fifth, by my understanding, the ‘VP-internal subject hypothesis’ is generally agreed to by syntacticians that the subject of a verb phrase is its ‘specifier’, and in that sense is higher than the verb but lower than any inflectional material.⁷ Accordingly, I conjecture that in English, the inflectional hierarchy for a sentence with an action-verb—one replaceable by ‘do’⁸—runs (parentheses for optional constituents, square brackets for mandatory constituents, slash for mandatory choice): [modal/tense morpheme](perfective)(progressive)[verb phrase].

⁹Heim and Kratzer, *Semantics*, 13; Dowty, ‘Compositionality’, 2.3.1.

- **Trivial Compositionality**

$$\llbracket O(\xi_1, \dots, \xi_n) \rrbracket = \llbracket O \rrbracket(\llbracket \xi_1 \rrbracket, \dots, \llbracket \xi_n \rrbracket)$$

Granting Trivial Compositionality, the semantic values of the sentences in (1) and (2) result from the application of the semantic value of ‘must’ to the semantic values of the nonfinite clauses in (6) and (7).

But how could that possibly be? There is nothing remotely deontic about the meaning of (4), no comparable contrast between its meaning and those of (5). That strongly suggests the absence of any contrasting deonticity in the semantic values of (6) and (7). If not, the only source of the contrast between (1) and (2) could be the modal. But Trivial Compositionality is not compatible with any such contrast.

1.2 A contextual-pragmatic effect?

Evidently, the explanatory apparatus so far needs to be somehow juiced. How? To begin, I take it to be obvious that semantic valuation should be contextually-relativized, rather than ‘absolute’. That opens the prospect of a ‘contextual-pragmatic’ explanation of the Obligation–Aspect Effect.

Let $\llbracket \xi \rrbracket^c$ abbreviate ‘the semantic value of the logical-form expression ξ as interpreted against the context c ’. Then consider the following compositionality principle, according to which semantic composition isomorphizes logical form-syntactic composition:

- **Contextualist Compositionality**

$$\llbracket O(\xi_1, \dots, \xi_n) \rrbracket^c = \llbracket O \rrbracket^c(\llbracket \xi_1 \rrbracket^c, \dots, \llbracket \xi_n \rrbracket^c)$$

Granting Contextualist Compositionality, the context-relative semantic values of the sentences in (1) and (2) result from the application of the context-relative semantic value of ‘must’ to the context-relative semantic values of the nonfinite clauses in (6) and (7).

According to a more-or-less orthodox conception of the semantics of modals developed by Kratzer,¹⁰ the semantic value of a modal in some way compares

¹⁰Kratzer, ‘Must and can’; Kratzer, ‘Notional category’.

the semantic value P of its operand to some class Q of worlds. For a necessity modal (including ‘must’, and also ‘shall’ and ‘should’), the issue is whether *all* Q -worlds are P -worlds; for a possibility modal (‘can’, ‘could’, ‘may’, ‘might’), the issue is whether *some* Q -worlds are P -worlds. The *restrictor* class Q emerges from the values of two parameters associated with the modal, the ‘modal base’ and ‘ordering source’. When the modal takes widest scope in a sentence, compositionality forbids the binding of that parameter, so its value must be supplied by the context. The reading supplied to a given occurrence of a modal (in a context) is determined by the value of its associated modal base and ordering source parameters. Epistemic, when the modal base contains just the worlds somehow taken seriously as epistemic possibilities; deontic, perhaps, when the modal base contains just the worlds compatible with our doing our duty. The job of the ordering source, when present, is to select the ‘minimal’ worlds in the modal base: absent an ordering source, the restrictor is the modal base; with an ordering source present, the restrictor is the ‘minimal’-world subset of the modal base (or perhaps the subset of worlds below a certain threshold). When the occurrence takes widest scope, the reading it is given in a context is somehow determined by a class of worlds that is salient in the context—in that sense, it is determined ‘contextually’.

So, according to the orthodoxy, the Obligation–Aspect Effect must be comparably contextual-pragmatic. The orthodoxy should insist on a very strong—but not mandatory—salience of a deontic modal base when the operand of ‘must’ is the semantic value of (6): thus (OA-i). And it should insist on the mandatory non-salience of a deontic modal base when the operand is the semantic value of one of the (7): thus (OA-ii). So whatever those semantic values may be, some contrast implicit in our tendencies to find certain modal bases salient is the source of the Obligation–Aspect Effect.

But it is not plausible that the Obligation–Aspect Effect results from our implicit tendencies to find modal bases salient. After all, the Obligation–Aspect Effect is peculiar to *obligational* modals. Nothing comparable is observed when the obligational strong modal ‘must’ is swapped for the non-obligational weak modal ‘should’:

8. Fred should open the door.
9. (a) Fred should be opening the door.

- (b) Fred should have opened the door.
- (c) Fred should have been opening the door.

In contrast with (1), (8) displays no strong (but defeasible) pull to a deontic reading: (8) deontic and epistemic readings are about equally attractive: so nothing comparable to (OA-i) is observed when ‘must’ is swapped for ‘should’. And in contrast with (2), (9) do not exclude deontic readings: again, deontic and epistemic readings are about equally attractive: so nothing comparable to (OA-ii) is observed when ‘must’ is swapped for ‘should’.¹¹

Interpreting the \square as representing ‘should’, the logical forms of (8) and (9) are just those in (1-LF) and (2-LF). Whatever set of worlds may be the operand of ‘must’ in (1), the same set should be the operand of ‘should’ in (8). And whatever sets of worlds may be the operands of ‘must’ in (2), the same sets should be the operands of ‘should’ in (9). But the pragmatic tendencies to which the explanation appeals are a function just of which nonfinite clause is the operand of the modal, and not to which modal is operative. It would appear, then, that there are no such pragmatic tendencies. If not, the contextual-pragmatic explanation of the Obligation–Aspect Effect fails.

1.3 A performative effect?

Ninan¹³ notes that (9b) has a deontic reading available, but (2b) cannot be read deontically and must be read epistemically. His explanation involves a *Semantic Component* and a *Speech-Act Component*. The Semantic Component says that, in (2b), the operand of *must* is a ‘proposition about the past’. The Speech-Act Component extends the resources available in the contextual-pragmatic explanation by postulating a distinctive ‘performative’ meaning of obligative uses of *must*: the Portneresque¹⁴ doctrine that ‘*must* is associated with putting propositions on

¹¹It appears that ‘must’ is the only modal with an obligative reading. But why is its dual, ‘could’—or perhaps ‘can’—not comparably obligative? Very sketchily:¹² first, negating a procedure is impossible: procedures conjoin and disjoin, but lack any sensible negation operation; second, a possibility-modal is defined in terms of the negation of its operand; third, the operand of an obligative modal is a procedure.

¹³Ninan, ‘Two puzzles’.

¹⁴Portner, ‘Semantics of imperatives’; Portner, ‘Imperatives and modals’.

To-Do Lists’—individual-relative sets of propositions constraining what is permissible for those among us.

Granting the Speech-Act Component, ‘it is only reasonable for someone to utter *must p* if the [subject] is able to make *p* true’; but the subject ‘can’t reasonably be expected to make *p* true’ when ‘*p* is a proposition about the past’, because ‘we can’t bring about past states of affairs’ (20). So, granting the Semantic Component, (2b) cannot have its obligative performative meaning. By contrast, ‘*should* [is] not associated with putting things on To-Do Lists’, so that (9b) ‘simply makes a claim about what’s going on in the relevant deontic alternatives, and there is no reason why such claims cannot concern the past’ (20).¹⁵

I embrace the general idea of affiliating the Obligation–Aspect Effect with the pragmatics of practical discourse. But Ninan’s implementation of this idea does not, to my mind, do it justice. I worry both about the haziness of the implementation and its superficiality. One consequence is that the approach should be treated as incomplete, pending further elaboration of fundamental hypotheses. Another is that it is unclear how Ninan should address certain fundamental concerns about both the Semantic and Speech-Act Components.

As implemented, Ninan’s story leaves several pieces of terminology undefined, and several hypotheses underspecified: the sense in which *must* is **associated** with modifying To-Do Lists; the **mechanisms** by which propositions are added to To-Do Lists; the notion of a proposition’s being **about the past**; and the **outer boundaries** of the psychological states one might occupy, while still reasonably attempting to make a certain adjustment to a To-Do List.

In addition, several powerful hypotheses are taken for granted without situating them in the context of a more expansive theoretical approach: that *must* **has a performative meaning** of adjusting To-Do Lists; that *should* **lacks this performative meaning**; that the operand in (2b) of *must* is a proposition **about the past**; that To-Do Lists are populated with **propositions**.

Certain questions about these powerful hypotheses are natural to ask. First, *must* clearly has obligative readings that do have the dynamic significance to which Ninan adverts. But it also has non-performative obligative readings, and

¹⁵This explanation receives at least tentative endorsement from [Hacquard](#), *Aspects of Modality*, 122–3; [Hacquard](#), ‘Aspect and modals’, appendix; and [Portner](#), ‘Imperatives and modals’, 363–6.

epistemic readings, and readings concerning natural tendencies ('what goes up must come down'). What unifies these readings?

Second, grant that *must* adjusts To-Do Lists but *should* does not. But why should this be? What is it about the meaning of *should* that makes this impossible—or about the meaning of *must* that makes it possible? What is the origin of this distinction in their meanings?

Third, grant that (2b) does involve the operation of *must* on a proposition about the past. But the nonfinite operand (7b) 'have opened the door' does not bear tense. So where does that past tense come from? It is true that *must* bears past tense, but that cannot be what Ninan requires: at least in (1), *must* is said to be operating on a proposition that is not in the past tense. It must be the perfective aspect in (2b) that somehow is responsible for the 'pastness' of the propositional operand of *must*. But the perfective is not in itself about the past: in the perfective progressive (2c), 'Fred has been opening the door.', there is no indication that the opening of the door is in the past. So to reiterate, why should the propositional operand of *must* in (2b) be in the past tense?

Fourth, why think To-Do Lists are populated with *propositions*? In making this choice, we represent practical psychology as indifferent to the subject, and to the present moment. After all, this allows as much freedom to populate my current To-Do List with the proposition that Caesar crossed the Rubicon in 49 BC as with the proposition that I walk the dog this afternoon. That would seem to represent me as committing to my own efficacy with regard to Caesar's crossing the Rubicon. If we commit to that, then we should not prohibit you from attempting to constrain my To-Do List by asserting 'Caesar must cross the Rubicon in 49 BC.'. But if we do not commit to that, then theorists should not stock To-Do Lists with propositions, but with entities that are more 'de se',¹⁶ that capture the linkage of practical psychology to the subject and the present moment. But if so, the Obligation–Aspect Effect is not explained by the futility of attempting to stock a To-Do List with a proposition about the past: it cannot be *futile* to attempt to do so, because it is *impossible* to attempt to do so.

These limitations in Ninan's theoretical edifice generate specific concerns about the Semantic and Speech-Act Components. Quotidian uses of (1) are not easily squared with the alluring affiliation of obligative meaning with *performative*

¹⁶Lewis, 'Attitudes'.

meaning, undermining the Speech-Act Component. And the hypothesis that, in (2b), the operand is *a proposition about the past* is insufficiently general to cover the full Obligation–Aspect Effect, undermining the Semantic Component.

On the Speech-Act Component. An alternative hypothesis about the affiliation of *must* with the pragmatics of obligation links *must* to the *statics* rather than the *dynamics*: by asserting (1), I ‘express’ rather than ‘impose’ Fred’s obligation. Ninan cannot accept this, because his explanation of the Obligation–Aspect Effect is fundamentally dynamic. Or, put another way, it is hard to see what prohibits me from expressing that Fred *was* under a certain obligation, and using (2b) to do so.

But the static hypothesis is more plausible than the dynamic hypothesis. After all, it is straightforward to imagine cases in which (1) is asserted even though Fred is manifestly already obeying a command to open the door (perhaps to explain why he has gotten up and is walking to the door). If it is manifest that Fred is already obeying, it would be in at least some way absurd to impose further obligations on the audience to enforce Fred’s obedience (perhaps the audience is on the phone in Florida and, in my belief, is not in a position to exert any influence on Fred). Is this a case in which the ‘association’ is broken, or would imposing further obligations not be absurd? Grant the former and obligative readings do not rely on Ninan’s postulated performative significance.

Could one defend the latter, that imposing further obligations would not be absurd? Ninan maintains ‘it is rational to undertake an action A to achieve some goal G only if one thinks that there is some chance that one will achieve G if one performs A’.¹⁷ But if I think Fred is already obeying, I do not think there is any chance that my asserting (1) will ‘achieve’ *any* benefit in regard to Fred’s opening the door. Asserting (1) would be pointless. But if pointless illocutionary acts are in perfectly good standing, why should we think *hopeless* illocutionary acts (like trying to get someone to change the past) are so problematic as to *shut down the availability of a reading* (rather than just making it seem goofy or silly)?

On the Semantic Component. It is not clear how to adequately generalize the attribution of the Obligation–Aspect Effect to the allegedly past-tensed operand of *must* in (2), along two dimensions. First, it is unclear what to say about (2a) in utterly humdrum speech acts; second, it is unclear what to say about uses of (2b) after a small bit of pragmatic gymnastics. If these generalizations cannot be

¹⁷Ninan, ‘Two puzzles’, 12.

made, then if aspect shuts off obligative readings, it is not because the semantic contribution of aspect is somehow affiliated with pastness.

Concerning (2a), ‘Fred must be opening the door.’ That progressive sentence is just as un-amenable to obligative reading as the perfective (2b). The progressive-aspect operand is not clearly read in the past tense. Should it be thought to be ‘about the present/future’, because aspect does the job of supplying tense to the propositional operand of a modal, with the progressive supplying present tense where the perfective supplies past tense? This would disunify the explanation for the full Obligation–Aspect Effect. Alternatively, should the propositional operand of (2a) be thought to be ‘about the past’, because the progressive involves *progression*? But if so, why think the proposition needs to be pegged to the speech time such that the progression has already started?

Concerning (2b) after pragmatic gymnastics. Recall that the temporal point of reference against which tenseless proposition-radicals are saturated can be shifted forward and backward. We might, for example, explicitly adjust the temporal reference point of speech to the future. Even so, it is hard to access a natural obligative reading for (2b)—even though, in this context, the propositional operand of *must* is not about the (‘true’) past. Even more challenging, parameters of context associated with ‘conversational score’, like To-Do Lists, can, familiarly,¹⁸ be adjusted by *accommodation*: helpful conversationalists attempt to ‘make the message make sense’. Perhaps the temporal ‘point of reference’ is also a component of conversational score. If so, why would we not accommodate an assertion of (2) by shifting the temporal point of reference into the future, and adding a proposition to the To-Do List that is ‘about the past’ from the adjusted point of view but ‘about the present/future’ from our current point of view?

It is hard to see how to answer these questions in the absence of a detailed theory of the interaction of aspect and modality, and a detailed formal pragmatics of practical language. No matter what, a treatment of the Obligation–Aspect Effect cannot avoid getting into the details. To my mind, it is perhaps better to make a fresh start than to set out already fixed on specific monsters to bar.

¹⁸Lewis, ‘Scorekeeping’.

1.4 A semantic effect

I draw several specific morals from this discussion of Ninan’s partial treatment of the Obligation–Aspect Effect. We should preserve the idea that obligative *must* involves its operation on entities that can populate To-Do Lists; and that assertions of (1) can adjust To-Do Lists. But first, the primary obligative meaning of (1) associates it with the *statics* rather than the *dynamics* of To-Do Lists; accordingly, the Obligation–Aspect Effect cannot be grounded in performative meaning. Second, To-Do Lists should not be stocked with propositions, but with entities that are more ‘de se’. Third, *must* must somehow have a meaning that allows it to operate either on propositions or on nonpropositional To-Do List constituents. But fourth, generating the epistemic reading of (1) requires a non-compositional effect. Fifth, the role of *aspect* in the Obligation–Aspect Effect is associated with the destruction of an entity’s capacity to occupy a To-Do List, rather than with its adjustment to a sort that would be futile to introduce to a To-Do List.

If the Obligation–Aspect Effect cannot be put up to contextual-pragmatic sources or to performative sources, there appears to be no where else for the orthodoxy to turn. A purely semantic explanation is available, if these morals are heeded; but it requires abandoning the orthodox conception of modals as quantifiers over worlds.

1.4.1 Repair Compositionality

The contextualist and performative approaches are united in accepting Contextualist Compositionality.

Perhaps other avenues remain for explaining the Obligation–Aspect Effect within Contextualist Compositionality. But it is not clear why we should hope to locate such an explanation. Contextualist Compositionality is too strong: quite frequently, $\llbracket O(\xi) \rrbracket^c$ is distinct from $\llbracket O \rrbracket^c(\llbracket \xi \rrbracket^c)$, and is instead sometimes $\llbracket O \rrbracket^c X$ —where X is somehow derived from $\llbracket \xi \rrbracket^c$.

This sort of phenomenon is ubiquitous, occurring whenever calculating a semantic value involves *repair* of a *type-mismatch*.¹⁹ For example,²⁰ a *description* can occur either as the subject of a sentence (10a) or as its predicate (10b):

¹⁹ Heim and Kratzer, *Semantics*, 67–8.

²⁰ Fara, ‘Descriptions as predicates’.

10. (a) The present King of France is bald.
 (b) Obama is the present King of France.

The semantic value of a description must be either an individual j (if descriptions are terms), a first-order property F (if descriptions are predicates), or a second-order property Q (if descriptions are quantifiers). Assume that Obama is the semantic value of ‘Obama’ (other theories of names just move the bump in the carpet).

No matter what, at least one of (10) involves a type-mismatch: the presentation to the semantic value of an operator an entity to which it cannot apply. If descriptions are terms, (10a) involves the action on j of $\llbracket \text{bald} \rrbracket$, the semantic value of ‘is bald’, but (10b) cannot involve the action of j on Obama. If descriptions are predicates, (10b) involves the action of F on Obama, but (10a) cannot involve the action of $\llbracket \text{bald} \rrbracket$ on F . If descriptions are quantifiers, (10a) involves the action of Q on $\llbracket \text{bald} \rrbracket$, but (10b) cannot involve the action of Q on Obama.

So no matter what, (10) must involve the repair of some type-mismatch: the extraction from one of the mismatched semantic values of an entity distinct from that semantic value which can enter operational combination with the other semantic value. If descriptions are terms, perhaps (10b) ‘lifts’ either Obama or j to a first-order property. If descriptions are predicates, perhaps (10a) ‘lifts’ F to a second-order property or ‘lowers’ it to an individual. If descriptions are quantifiers, perhaps (10b) ‘lowers’ Q to a first-order property or ‘lifts’ Obama to a first-order property. Only through some such repair can each operator in (10) receive as its semantic argument an entity to which it can be applied.

The core of my explanation of the Obligation–Aspect Effect is the rejection of Contextualist Compositionality for *Repair Compositionality*:

- **Repair Compositionality**²¹

Let $\llbracket O \rrbracket \in y/x_1 \dots x_n$,²² and let $[x|z] \in (x/z)$ be a legitimate type-repair operation (where $[x|x]$ is the identity operation):

²¹Officially, this principle is contextually relativized: I invite the reader to mentally replace every $\llbracket \xi \rrbracket$ with a $\llbracket \xi \rrbracket^c$. I suppress this relativization here and for the rest of the section (a) to reduce clutter and (b) to highlight the noncontextualist character of my explanation.

²²I use the notation of ‘categorical grammar’:²³ $R/D_1 \dots D_n$ is the set of functions with domain $D_1 \times \dots \times D_n$ and range R ; if $f \in R/D$ and $a \in D$, then $f(a) \in (R/D)(D) = R$.

If $\llbracket \xi_1 \rrbracket \in z_1, \dots, \llbracket \xi_n \rrbracket \in z_n,$

$$\llbracket O(\xi_1, \dots, \xi_n) \rrbracket = \llbracket O \rrbracket([\mathbf{x}_1|z_1]\llbracket \xi_1 \rrbracket, \dots, [\mathbf{x}_n|z_n]\llbracket \xi_n \rrbracket),$$

Whenever the left hand side is defined

Note that because $[x|x]$ is the identity operation, Contextualist Compositionality is equivalent to the restriction to repair-free cases of Repair Compositionality.

1.4.2 A proposal for semantic typing

In its particulars, the Obligation–Aspect Effect is an artifact of the semantic value-types of the constituents represented in the logical forms of (1) and (2), and of the strategies available for repairing type-mismatch when it arises. To be explicit, my explanation appeals to the following principles (I intersperse intuitive glosses, to be expanded upon in later sections):

(A) Clausal semantic values

- i. The semantic value of a declarative sentence belongs to type p —the *propositions*
- ii. The semantic value of an uninflected clause like (6) belongs to type π —the *procedures*
- iii. A third type of clausal semantic value is type r —the *eras*

(i) A proposition is an ‘unstructured’ set of possible worlds;²⁴ (ii) a procedure is a ‘structured’ entity, loosely akin to a ‘Russellian proposition’,²⁵ but with imperatival rather than declarative structure—and therefore also the content of an imperative sentence; (iii) an era is a function from worlds to temporal open intervals.²⁶

(B) Temporal perspective

- i. $\llbracket \text{perf} \rrbracket, \llbracket \text{prog} \rrbracket \in r/r$

²⁴Stalnaker, ‘Pragmatics’.

²⁵Salmon, *Frege’s Puzzle*.

²⁶The open interval (t', t'') is the set $\{t : t' < t < t''\}$ —‘<’ representing temporal precedence, of course.

ii. $\llbracket \text{PAST} \rrbracket, \llbracket \text{PRES} \rrbracket \in p/r$

(i) An aspectual modifier maps eras to eras; (ii) tense maps eras to propositions.

(C) Modality

i. $\llbracket \square \rrbracket \in p/(p \cup \pi)$

ii. The obligative reading of ‘must’ involves the action of its semantic value on an operand of type π , while the epistemic reading involves an operand of type p

(i) ‘Must’ can take as its operand either a proposition or a procedure and maps to a proposition; (ii) an obligative reading involves, effectively, a modalized imperative, while an epistemic reading involves a modalized declarative.

(D) Type-repair

i. (a) There is an ordering \leq on the clausal semantic value-types, with $p < r < \pi$

(b) A type-repair operation can only *lower* the type of the operand, and only by one step

(c) By (a) and (b), $[p|r]$ and $[r|\pi]$ are legitimate type-repair operations, but none of these are: $[p|\pi]$ (two hops down); $[r|p]$ and $[\pi|r]$ (upward); $[\pi|p]$ (two hops up).

ii. When both are available, a reading involving less type-repair is preferred to a reading involving more type-repair

(i) The ordering reflects semantic complexity—propositions are least complex, eras of intermediate complexity, procedures maximally complex—and complexity can always be thrown out, but once thrown out, cannot be recovered; (ii) type-repair is perhaps ‘cognitively demanding’ so that we avoid it when we can.

1.4.3 Explaining the Obligation–Aspect Effect

Repeated appeal to Repair Compositionality, (A), (B), (C-i), and (D-i) yields the *type-structures* (the pattern of function- and argument-types, revealing occurrences of direct application and repair) involved in the calculation of the semantic values of (6)–(7) and (1)–(2)—for good measure, I throw in also (4)–(5) (and to reduce clutter, I drop context-relativization):

$$(6\text{-TS}) \quad \llbracket \text{Open}(f) \rrbracket \in \pi$$

$$(7\text{-TS}) \quad \begin{aligned} \text{(a)} \quad & \llbracket \text{prog}(\text{Open}(f)) \rrbracket \\ &= \llbracket \text{prog} \rrbracket [r|\pi](\llbracket \text{Open}(f) \rrbracket) \\ &\in (r/r)((r/\pi)(\pi)) = (r/r)(r) = r \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & \llbracket \text{perf}(\text{Open}(f)) \rrbracket \\ &= \llbracket \text{perf} \rrbracket [r|\pi](\llbracket \text{Open}(f) \rrbracket) \\ &\in (r/r)((r/\pi)(\pi)) = (r/r)(r) = r \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad & \llbracket \text{perf prog}(\text{Open}(f)) \rrbracket \\ &= \llbracket \text{perf} \rrbracket (\llbracket \text{prog} \rrbracket [r|\pi](\llbracket \text{Open}(f) \rrbracket)) \\ &\in (r/r)(r) = r \end{aligned}$$

$$(1\text{-TS}) \quad \begin{aligned} \text{(i)} \quad & \llbracket \square(\text{Open}(f)) \rrbracket \\ &= \llbracket \square \rrbracket (\llbracket \text{Open}(f) \rrbracket) \\ &\in (p/(p \cup \pi))(\pi) = p \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & \llbracket \square(\text{Open}(f)) \rrbracket \\ &= \llbracket \square \rrbracket [p|r][r|\pi](\llbracket \text{Open}(f) \rrbracket) \\ &\in (p/(p \cup \pi))((p/r)((r/\pi)(\pi))) \\ &= (p/(p \cup \pi))((p/r)(r)) \\ &= (p/(p \cup \pi))(p) = p \end{aligned}$$

$$(2\text{-TS}) \quad \begin{aligned} \text{(a)} \quad & \llbracket \square(\text{prog}(\text{Open}(f))) \rrbracket \\ &= \llbracket \square \rrbracket [p|r](\llbracket \text{prog} \rrbracket [r|\pi](\llbracket \text{Open}(f) \rrbracket)) \\ &= (p/(p \cup \pi))((p/r)(r)) \\ &= (p/(p \cup \pi))(p) = p \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & \llbracket \square(\text{perf}(\text{Open}(f))) \rrbracket \\ &= \llbracket \square \rrbracket [p|r](\llbracket \text{perf} \rrbracket [r|\pi](\llbracket \text{Open}(f) \rrbracket)) \end{aligned}$$

$$(c) \llbracket \Box(\text{perf prog}(\text{Open}(f))) \rrbracket \\ = \llbracket \Box \rrbracket [p|r] (\llbracket \text{perf} \rrbracket (\llbracket \text{prog} \rrbracket [r|\pi] (\llbracket \text{Open}(f) \rrbracket)))$$

$$(4\text{-TS}) \llbracket \text{PRES}(\text{Open}(f)) \rrbracket \\ = \llbracket \text{PRES} \rrbracket [r|\pi] (\llbracket \text{Open}(f) \rrbracket) \\ \in (p/r)((r/\pi)(\pi)) \\ = (p/r)(r) = p$$

$$(5\text{-TS}) (a) \llbracket \text{PRES}(\text{prog}(\text{Open}(f))) \rrbracket \\ = \llbracket \text{PRES} \rrbracket (\llbracket \text{prog} \rrbracket [r|\pi] (\llbracket \text{Open}(f) \rrbracket)) \\ \in (p/r)(r) = p$$

$$(b) \llbracket \text{PRES}(\text{perf}(\text{Open}(f))) \rrbracket \\ = \llbracket \text{PRES} \rrbracket (\llbracket \text{perf} \rrbracket [r|\pi] (\llbracket \text{Open}(f) \rrbracket))$$

$$(c) \llbracket \text{PRES}(\text{perf prog}(\text{Open}(f))) \rrbracket \\ = \llbracket \text{PRES} \rrbracket (\llbracket \text{perf} \rrbracket (\llbracket \text{prog} \rrbracket [r|\pi] (\llbracket \text{Open}(f) \rrbracket)))$$

The central point to observe here is the asymmetry between (1-TS) and (2-TS): the former has both a type-structure (i) involving zero instances of type-repair and a type-structure (ii) involving two such instances; the latter have only type-structures involving one instance of type-repair. The structural basis of this asymmetry is (D-i), which allows type-lowering repair from π to r and from r to p , but forbids type-raising repair. By (C-i), ‘must’ can accept operands of either the highest type π or the lowest type p . In (1), the operand is of the highest type π , and so can be taken either ‘as is’ or lowered twice. But in (2), the operand is of the intermediate type r , and therefore must be lowered.

My explanation of the Obligation–Aspect Effect applies the remaining principles (C-ii) and (D-ii) to this asymmetry:

(OA-i) By (C-ii), (1-TS) illustrates that (1) has both an epistemic and a deontic reading: the deontic reading is in (1-TS(i)), the epistemic reading in (1-TS(ii)). But the former involves zero type-repair operations, while the latter involves two. So, by (D-ii), the epistemic reading should be much harder to access—in line with (OA-i).

(OA-ii) The (2-TS) illustrate a need for type-repair in order that the modal may operate on the nonfinite inflected clause. But that repair requires the lowering

of the type of the operand to *p*. So, by (C-ii), the (2) have only epistemic readings—in line with (OA-ii).

A purely semantic explanation, as promised, with no further pragmatic speculation required: we are done.

(Why the contrast between (1)–(2) and their ‘should’-variants: (8), ‘Fred should open the door.’, and (9), ‘Fred should be opening the door.’ and so on? I speculate: Yalcin (forthcoming in *Deontic Modals*) maintains that ‘should’ is a ‘modal of normativity’—very roughly, (8) means that a proposition extracted from ‘Fred open the door’ is maximally *expected*. Levels of expectation can only be assigned to propositions, never to procedures, so type-mismatch repair is mandatory—so there is no distinctive pull toward a deontic reading of (8), in contrast with (OA-i). But expectation is a polymorphous attitude, taking shape either ‘ethically’ or ‘predictively’: so neither the deontic nor the epistemic reading has any special weight over the other with a propositional operand—so there is no mandate to read (9) non-deontically, in contrast with (OA-ii).)

But why believe (A)–(D)? Collectively, because they afford an explanation of the Obligation–Aspect Effect. Individually, each is independently defensible: section 2 discusses the uninflected clause, focusing particularly on defending (A-ii); section 3 discusses temporal perspective, defending (B); and section 4 discusses modals, defending (C). Defense of (D) is distributed over sections 3 and 4.²⁷

²⁷Interaction between aspect and modals has been influentially discussed by Hacquard, *Aspects of Modality*; Hacquard, ‘Aspect and modals’. Hacquard’s approach is intricate, treats a budget of subtle cross-linguistic data, and embraces the central commitments of the Kratzerian approach to modals: for these reasons, space allows only a few cursory remarks.

As I understand it, Hacquard’s central quarry is the ‘low modal’ as contrasted with the ‘high modal’: on her telling, the former attach directly to VP and scope under temporal perspective, while the latter scope over temporal perspective. Hacquard proposes a slightly disunified semantics for the high and the low, with the high attaching to propositions and the low attaching to properties of events.

Her focus is this puzzling ‘actuality entailment’: ‘we were able to make it to the beach yesterday’ allegedly entails that we made it to the beach yesterday, despite being a possibility modal. (Isn’t it true though that we were also able to sit around the house all day yesterday?) But perplexingly, in Romance, that entailment can be turned on or off through appropriate aspect: perfective turns it on, imperfective turns it off—the ‘Bhatt effect’.

Hacquard appeals to the Kratzer theory of aspect (I discuss this in note 75) to extract a perfective meaning on which some actual event has a bunch of counterparts which are trips to the beach: various enrichments pertaining to the transworld identification of events are deployed to conclude

2 The uninflected clause

This section explicates and defends (A-ii): that the semantic value of an uninflected clause like (6), ‘Fred open the door’, is a sort of structured abstract entity I have been calling a ‘procedure’.

My case allies uninflected clauses with imperatives, and then appeals to a conception of the meaning of imperative sentences allied in its framework assumptions with that of Portner.²⁸ Very roughly: (i) theorizing about imperative semantics must fit with the formal pragmatics of command; (ii) the latter must accommodate the use of commands to motivate action; (iii) and the latter must fit with a rational psychology of practical motivation. Portner anchors (ii) in the Stenius-Lewis conception of command as control, and (iii) in the Lewis-Stalnaker conception of motivation as desire-satisfaction. But in my view, neither conception is adequate;²⁹ (A-ii) falls out once they are replaced.

To get the flavor of my argument, suppose Fred forms, just on his own, the that anything with a bunch of counterparts which are trips to the beach must also be a trip to the beach. Regarding the imperfective: the alleged imperfective paradox has led to a tradition in semantics of modalizing the imperfective; in Hacquard’s view, an allegedly rich modal significance of the imperfective is what extinguishes the entailment (the details are sparse: ‘Providing a unified account of the imperfective that covers all of these readings is beyond the scope of this paper. It is unclear that a single modal operator could do the job, and one may want to treat the imperfective as some kind of default triggered by various modal operators’ (section 2.2.2)).

In the view of this article, obligative ‘must’ is a ‘high modal’: if so, Hacquard’s manoeuvres in pursuit of the Bhatt effect are orthogonal to the discussion.

Of course, in the Kratzerian program, ‘deontic’ modals are low modals, in light of their ‘circumstantial’ rather than ‘epistemic’ ‘modal base’; the only high modals are ‘epistemic’. But first, the category of the ‘deontic’ is disunified: witness the contrast between (1)/(2) and (8)/(9). Second, if epistemic modals are high, and Yalcin’s (Yalcin, ‘Epistemic modals’) approach to epistemic modals is correct, then my broadly similar approach to obligative modals predicts that they too are high. Third, according to my theory, obligative modals have no ‘modal base’, whether circumstantial or epistemic. If the Kratzer approach is correct, I am already done for; this further worry would be beating a dead horse. But fourth, Hacquard, ‘Aspect and modals’, appendix appears to acknowledge that obligative modals are high modals. Fifth and finally, Hacquard’s brief remarks on the Obligation–Aspect Effect are limited to tentative approval of the approach in Ninan, ‘Two puzzles’: on which see section 1.3.

²⁸Portner, ‘Semantics of imperatives’; Portner, ‘Imperatives and modals’: compare also Charlow, ‘Statics and dynamics’; Charlow, *Practical Language*; Charlow, ‘Logic and semantics’, and Starr, ‘Preference’.

²⁹Nor, consequently, is Ninan’s Portneresque treatment of the Obligation–Aspect Effect, as I argued in section 1.3.

intention to open the door: right now—the intention is ‘in-action’ as opposed to ‘prospective’.³⁰ What ‘motivates’ this—what is the psychological explanation that makes sense of Fred’s forming this intention? Attention to the structure of practical reason, in my view, reveals that this is always because Fred is following some structured procedure which has just now called for him to open the door.

Now suppose Sam commands Fred to open the door. Assuming the situation is ‘canonical’—the command is legitimate, Fred understands it and accepts it, nothing psychologically unexpected is going on—Fred will be motivated to open the door. But by what is he motivated? The question is a psychological one, so some psychological state motivates Fred. By parity, we should say this too involves a state of following a procedure; but whose? I will argue that the motivating state belongs to a *social agent* composed of Sam and Fred, and that the purpose of Sam’s command is to call attention to this social attitude. What is the content of the *command*, then? The straightforward answer is that the content of the command is the same as the content of that attitude: so it too is a procedure.

Now suppose Sam commands Fred by using the following *imperative sentence* (11):

11. Fred open the door!

In doing so, Sam commands Fred to open the door. As above, the content of that command is a certain procedure. What is the semantic value of the *sentence* (11) Sam uses in the command, interpreted against a context representing the situation of command? The straightforward answer is that the semantic value of the sentence interpreted against the context is the same as the content of the command: so it too is a procedure.

And how does all this relate to the semantic value of the uninflected clause (6)? Superficially, it is the same as the imperative sentence (11). So the straightforward answer is that the semantic value of the clause (6) interpreted against the context is the same as the semantic value of the sentence (11) interpreted against the context: so it too is a procedure.

More sharply. Let $[[\xi]]^c$ abbreviate ‘the semantic value of the expression ξ interpreted against the context c ’. Over the course of the section, I defend these premisses:

³⁰Searle, *Intentionality*.

- P1. Whenever Fred is motivated to open the door, the³¹ motivating psychological state is a state of following a procedure
- P2. The content of a command motivating Fred to open the door in a canonical situation is the content of the psychological state in that situation motivating Fred to open the door
- P3. For any c and any canonical situation represented by c , $\llbracket(11)\rrbracket^c$ is the content of a command performed with (11) in that situation
- P4. $\llbracket(11)\rrbracket^c = \llbracket(6)\rrbracket^c$

I now argue as follows. By (P1) and (P2), the content of a command motivating Fred to open the door in a canonical situation is a procedure. Because, in a canonical situation, a command performed with (11) motivates Fred to open the door, by (P3), for any c , $\llbracket(11)\rrbracket^c$ is a procedure. So, by (P4), $\llbracket(6)\rrbracket^c$ is a procedure—in accord with (A-ii).

2.1 Motivation

I begin with (P1): whenever Fred is motivated to open the door, the motivating psychological state is a state of following a procedure. This is a consequence of a theory of ‘rational architecture’ I find alluring. Because of space, I proceed swiftly and directly.³²

2.1.1 Rationalization of action

According to the classical Stalnaker-Lewis conception of practical rationalization,³³ Brent’s actions are explained by Brent’s beliefs and desires. The content of Brent’s beliefs at a time is given by a set B of those possible worlds he takes seriously as candidates for actuality; the content of Brent’s desires is given by a set D

³¹Here I mean the ‘most immediately’ motivating such state: states motivating *that* state may not themselves be procedural attitudes.

³²The story in this section is intended to sharpen and in certain respects improve upon the perspective on rationalization of action presented in Anscombe, *Intention*, and, more recently, in Thompson, ‘Naive action theory’; see also Ford et al., ‘Introduction’; Hornsby, ‘Actions’.

³³Stalnaker, *Inquiry*; Lewis, *Plurality*.

of those possible worlds in which Brent's desires are satisfied. Many options have been explored for extracting actions from such a pair. The simplest way forward³⁴ is perhaps this: if, throughout $B \cap D$, at t , Brent does so-and-so, then—on pain of unintelligibility—at t , Brent in fact does so-and-so.

That is really very much too simple. First, Brent can desire to prepare a Black Forest cake without knowing how to do so, and therefore do nothing about it. Second, Brent can desire to take off for the beach while otherwise committed, and therefore do nothing about it. Third, we may assume that belief evolves under the impact of evidence by conditionalization.³⁵ But without any kinematics of desire, there is no reason to suppose Brent's desires do not thrash about wildly in a manner incompatible with the sustaining of action. Fourth, practical motivation appears to be essentially 'de se et nunc' and future-directed—it is *I* who act, starting *now*, and in ways constraining what I do going forward—but neither propositional beliefs nor propositional desires have any of these features.

Fifth, and more subtly, conditional practical motivation is *information-sensitive*, and therefore eludes such treatment. If Speculating Sandra knew the market were headed up, she would go long; if Speculating Sandra knew it were headed down, she would go short; but Speculating Sandra has no idea, so she keeps her money under her mattress.³⁶ In any world in which Speculating Sandra gets what she wants and the market heads up, she goes long; in any world in which the market heads down, she goes short: there are no worlds in D in which the market heads either up or down and she keeps her money under her mattress. Perhaps Speculating Sandra is confident that the market will go either up or down (it will not stay put): throughout B , the market goes either up or down. So throughout $B \cap D$, Speculating Sandra is either going short or going long—she never keeps her money under her mattress. But that is what in fact she does! So the model rules Speculating Sandra unintelligible. But hedging against imperfect information is completely intelligible. So the model is incorrect.

³⁴Lewis, 'Problem'.

³⁵Lewis, 'Why conditionalize?'.

³⁶Compare Kolodny and MacFarlane, 'Ifs and oughts'.

2.1.2 Practical contents

These shortcomings can all be remedied, at the cost of some complexity: Stalnaker-Lewis is largely correct about belief, but the story of practical motivation needs to be complicated quite a lot.

With Stalnaker-Lewis, belief-contents involve a set of possible worlds, the content of ‘de dicto belief’; but Brent’s belief-content at t^* also involves a *self-location* parameter specifying accurately and determinately Brent’s identity and the time t^* . If, at t^* , Brent has de dicto belief given by the proposition B , Brent derivatively has the self-locating belief the content of which is the ‘property’ (set of centered worlds) P containing $\langle w, t, j \rangle$ just if $w \in B$, $t = t^*$, and j is Brent.³⁷

But *desire* alone won’t do as a practical attitude (indeed, desire has no place in my story). In my story, the three practical attitudes are *intention*, *knowhow*, and *following*. Intention is required because of a link to belief, and then via evidence to behavior. Following is required in order to provide structure to the course of very short-term intentions guiding action from moment to moment, such that they might add up to the successful execution of longer-term intentions. And knowhow is required in order to make sure that longer-term intention does in fact get successfully implemented by the structure eventually imposed by following on very short-term intentions. Without very short-term intention, long-term intention would be powerless; without long-term intention, very short-term intention would be pointless. What attaches the point to the power is a cyclical decompositional transition from intention to knowhow to following and back to intention.

Let the (*open*) *interval* (t, t') be the set of moments of time strictly between t and t' . Let an *extended centered world* be a world-interval-individual triple $\langle w, I, j \rangle$. An *action-kind* is a set of extended centered worlds: for example, *running around the block* is the set containing $\langle w, (t, t'), j \rangle$ just if, in w , at t , j commences a run around the block which concludes at t' . It will later be important to

³⁷It is customary to allow for self-identifying ignorance and error, employing instead sets of centered possible worlds for belief-contents (Lewis, ‘Attitudes’): Brent’s belief-content at t^* includes $\langle w, t, j \rangle$ just if Brent takes seriously this prospect: things are as in w , the present moment is t , and he is j . In my view, that is going overboard: there are no cases of self-identifying ignorance or error under *absolutely every mode of presentation*, which is what would justify that manoeuvre. Indeed, the moment-to-moment adjustment of behavior in response to evidence required by intentional action is arguably incompatible with self-locating ignorance or error. For a somewhat sympathetic view on this, compare Stalnaker, *Internal*.

make self-locating belief contents comparable with action-kinds: let the *evolution* of a property P , $\mathcal{E}(P)$, is the set of extended centered worlds (aka the action-kind) containing $\langle w, (t, t'), j \rangle$ just if $\langle w, t, j \rangle \in P$.

The *procedures* are generated inductively from the action-kinds together with a stock of *programmative markers*.³⁸ Any action-kind K is a procedure. Where K is an action-kind and P is a property, any *conditionalization* K/P is a procedure. Any sequence of either of these programmative markers followed by any number of procedures is a procedure: **Con**, representing the *concurrent* pursuit of a number of actions; **Alt**, representing the *alternative* pursuit of at least one of a number of actions. Any pair of one of these markers followed by a procedure is a procedure: **Ref**, representing the *refrainment* from an action; $[x]$, representing the delay of an action for x units of time; $[Q]$, representing the delay of an action until one satisfies the property Q . Perhaps other programmative markers should be introduced.

The procedures can be made comparable with the action-kinds. Let an *unconditional* procedure be one with no conditionalizations as leaf nodes. Then the *execution* of an unconditional procedure Π , $\mathcal{X}(\Pi)$, is intuitively supposed to be the action-kind that results from aggregating the action-kinds in Π in the manner specified by its programmative markers. I spell out the details elsewhere;³⁹ for example, $\mathcal{X}(\mathbf{Alt}, K, K')$ is the union set of K and K' , $\mathcal{X}(\mathbf{Ref}, K)$ is the complement of K , and $\mathcal{X}(\mathbf{Con}, K, K')$ is (something like) their intersection.⁴⁰ All of these are easily verified to be action-kinds. Conditional procedures require a notion of *conditional execution*. Informally, let $\Pi|R$ be the procedure extracted from Π by converting K/P to K whenever $R \subseteq P$ and otherwise striking K : then set $\mathcal{X}(\Pi|R)$, the execution of Π given R , to $\mathcal{X}(\Pi|R)$.

Because $\mathcal{E}(P)$ and $\mathcal{X}(\Pi)$ are both action-kinds, they are comparable, and further action-kinds may be extracted from them by applying set-theoretic operations. A particularly significant such extract is the *execution of Π from P* : $\mathcal{E}(P) \cap \mathcal{X}(\Pi)$. That is the action-kind one performs by necessity if, commencing in circum-

³⁸The story I present here is a ‘shell’ on a more content-based story I discuss in Hellie, ‘Motivation and modality’: roughly, procedural contents are sets of alternatives; where an alternative is a set of (possibly conditional) action-kinds, possibly dotted about in the future and/or across cooperating individuals.

³⁹Hellie, ‘Motivation and modality’.

⁴⁰Specifically: $\mathcal{X}(\mathbf{Con}, K, K') = K * K'$ such that $\langle w, (t^*, t), j \rangle \in K$ and $\langle w, (t^*, t'), j \rangle \in K'$ just if $\langle w, (t^*, \max(t, t')), j \rangle \in K * K'$.

stances characterized by P , one goes on to work through Π . Similarly, for any action-kind K , if $\mathcal{E}(P) \cap \mathcal{X}(\Pi) \subseteq K$, one performs K by necessity if commencing in P -circumstances one works through Π . In that case, say that Π *implements* K from P . For conditional instructions, a bit more complexity is required: Π implements K from P given R just if $\mathcal{E}(P \cap R) \cap \mathcal{X}(\Pi/R) \subseteq K$. And then Π implements K from P *simpliciter* if for every $R \subseteq P$, Π implements K from P given R . (For unconditional Π , the two definitions are equivalent.)

Because *implementation* is a relation of metaphysical necessity, it may be used to represent the constitution of more complex or longer-term actions by aggregates of simpler or shorter-term actions. For example, we may imagine a procedure for building a tower: place a first block on a stable surface; then balance a second block atop the first; then balance a third block atop the second. If one executes that procedure from normal circumstances, one will have thereby built a tower.

2.1.3 Practical attitudes

Implementation may also be used to characterize the contents of *knowhow*: entities of a kind I call *instructions*.⁴¹ An instruction is a triple $\langle K, P, \Pi \rangle$ such that Π implements K from P . The contents of knowhow are sets of instructions: one knows how to K from P just if for some Π (which implements K from P), one grasps the instruction $\langle K, P, \Pi \rangle$. But not any arbitrary set of instructions can specify the content of someone's knowhow: I have to know how to do what it takes to do what I know how to do. After all, I might know that if one does A and does B , one will do C but not know how to do B —if not, the former would not constitute knowledge how to do C . Knowhow therefore requires what I call *grasp* of an instruction, a more demanding condition requiring grasp of instructions 'all the

⁴¹ Stanley and Williamson, 'Knowing how' and now Stanley, *Know How* argue that knowhow is 'propositional'. Understood to mean that the content of knowhow is a set of possible worlds, I disagree. All knowhow is conditional, and reflects relations of metaphysical necessity among circumstances, constituting means, and governing actions. Accordingly, there is not a fortiori any difference between the information held by one who has a certain article of knowhow and one who lacks it. But on the broader question whether knowhow is 'rational', I am in agreement with Stanley (though Jennifer Hornsby has called to my attention language of Stanley's on which explanatory appeal is made to 'subpersonal processes', so perhaps Stanley is less than whole-hearted in this commitment).

way down'. The details depend on the intricacies of the theory of procedures, but here is an example: to grasp $\langle K, P, \langle \text{Alt}, K', K'' \rangle \rangle$, one must also grasp further instructions that specify, for any situation in P , either how to K' or how to K'' . This recursiveness to the characterization of grasp ensures that one can never know how to do something in circumstances one in fact occupies and yet be wrong-footed because one does not how to take some small but necessary step.

Knowhow is 'passive': it ensures that *if* one sets about doing something one knows how to do under circumstances one in fact occupies, one will do it. But it says nothing about what one is in fact doing. In order to actually get up and *do* what one knows how to do, one has to set about doing it—or, in the jargon, one has to form an intention(-in-action: henceforth I leave this qualification tacit) to do it. To capture this, I postulate an attitude of *intention*, the contents of which are *sets of action-kinds*. In particular, if Brent is intentionally building a tower at t^* , then the action-kind *build a tower* is a member of the set giving the content of Brent's intentions.

Forming an intention requires exploiting one's knowhow: one cannot set about doing something with intention unless one knows how to do it under circumstances one takes oneself to occupy. Why should this be? Knowhow specifies procedures to implement action-kinds from circumstances—so presumably knowhow is required for intentional K -ing because without it, one will not have available a procedure that would implement one's K -ing. But that would only matter if intentional K -ing required taking an attitude toward such a procedure. So I postulate such an attitude: I call it *following*.

Following and intention are distinct: they have different contents, with the procedure-contents of following significantly more complex than the action-kind-contents of intention. But they are closely related: whenever one forms an intention to K believing oneself to occupy P , for some $\langle K, P, \Pi \rangle$ one grasps, one thereby sets about following Π —on pain of unintelligibility. So intention and belief influence the content of following, by injecting appropriate procedures in accord with knowhow.

But following Π feeds back in turn to intention. Following 'keeps the books' for action. If I form the intention to build a tower, I must first place a first block on a stable surface; and then (not long after, and not before) I must balance a second block atop the first. But at the time I form the intention to build the tower,

the only action I commence is placing the first block. Why should I ever get around to placing the second block—and why should I do so at the appropriate time? This happens because following keeps track of belief, and fires action-kinds back over to intention under appropriate circumstances. The complexity of procedures makes the story here complex, but the moral is clear: belief and following influence the content of intention, by injecting appropriate action-kinds in accord with the stages one has reached in the procedures one is following. (In particular, if one is following a conditional procedure calling for K -ing when Q if R , an intention to K is triggered when one's belief state is a subset of Q only if it is also a subset of R .)

It is said that we believe we will act as we intend.⁴² But why would this matter? To answer, let us represent it. The content of Brent's intention at t^* is a set of action-kinds—not a proposition, and so not yet believable, but a proposition can be extracted from this set. The triple $\langle K, t, j \rangle$ determines a set of worlds $\mathcal{S}\langle K, t, j \rangle$, the *success-condition* for j 's K -ing at t : this set contains w just if for some I containing t , $\langle w, I, j \rangle \in K$. The *global* success condition for the content of j 's intentions at t is then the set of worlds in which all j 's intended actions succeed: namely, if N is the content of j 's intentions at t , its global success-condition $\mathcal{S}\langle N, t, j \rangle = \bigcap_{K \in N} \mathcal{S}\langle K, t, j \rangle$. To say that we believe we will act as we intend is then to say that if B and N are the content of j 's de dicto belief and intentions at t , $B \subseteq \mathcal{S}\langle N, t, j \rangle$.

Why does it matter? First, it ensures a sort of consistency of intention: if what I currently intend has a nonvacuous global success condition but adding K would collapse it to vacuity, then the belief-condition would collapse my beliefs to inconsistency.

But second, it also affords the link between practical reason and *action*—behavior guided by practical reason. Brent, presumably, accumulates evidence about certain aspects of his behavior: for example, if Brent moves his arms a certain way over an interval, his evidence at the end of the interval may entail the proposition that Brent's arms have moved that way over the interval. Let the proposition E be the content of j 's evidence about j 's behavior accumulated over a certain interval concluding at t , and let the proposition B represent j 's beliefs at

⁴² Anscombe, *Intention*; Harman, 'Practical reasoning'; Velleman, *Practical Reflection*; for disagreement, see Davidson, 'Agency'; Bratman, *Intention*; Setiya, *Reasons Without Rationalism*.

t. Suppose that evidence is both true and believed: it follows both that E is true and that $B \subseteq E$. A consequence of this is that E has a non-null intersection with $S!(N, t, j)$: it is consistent with what one knows evidentially about one's behavior that all of one's intentions will succeed. Because this global success-condition is the intersection of the success-condition for each of one's intentions, each of one's intentions is such that it is consistent with what one knows evidentially about one's behavior that *it* succeeds.

Intentions are directed toward the future, and one's evidence stops at the present, so one does not know by evidence that any of one's intentions will succeed. But if one has intentions concerning how one will behave over the very short term, it may be that the success-condition for such an intention is presupposed by the interpretive strategy through which one 'processes' the given,⁴³ and thereby appears to be built into one's evidence. If so, the conjunction F of that apparent evidence with the negation of that success-condition—the failure-condition for that intention—is the vacuous proposition. Believing the vacuous proposition is unintelligible; and what can't be intelligibly believed can't be believed. So it is unbelievable that one's intention for behavior over the very short term should fail. If it fails, that would be incomprehensible. So if, over a certain interval, the success of all Brent's momentary very short-term intentions requires that Brent behave in a certain way over that interval, then—on pain of unintelligibility—Brent in fact does behave in that way over the interval.

2.1.4 Advantages

The story is complex, but no less than is required to remedy the various difficulties with the Stalnaker-Lewis approach. First, one can only intend what one knows how to do, so Brent's desire to prepare a Black Forest cake will have no impact when he does not know how. Second, Brent's intentions are injected by the procedures he is following, which are in turn (in general) injected by further intentions. So if Brent is carrying out certain commitments, the only intentions he will form are those required to implement those commitments. If they are incompatible with Brent's going to the beach, too bad: whether he desires to will have no impact. Third, while I have been sketchy on the details, the general moral

⁴³Hellie, 'There it is'; Hellie, 'Love'.

about the kinematics of intention is, I hope, clear: it is under the tight governance of the procedures one is following. If procedures hang around until they are complete—and I hereby assert that they do—there will be no thrashing around. In fact, the complexity of the account secures exactly the opposite: by allowing practical attitudes to decompose arbitrarily minutely and also to be conditionalized, the account provides exactly a sense in which practical attitudes ‘guide’ action.⁴⁴ Fourth, intention is *de se et nunc*: its contents are action-kinds, which are (fancy) properties. Moreover, following is future-directed: it tracks one’s circumstances as one passes from past to future, firing off intentions as appropriate.

Fifth, the theory predicts the information-sensitivity of practical reason. Recall Speculating Sandra: her intention is, say, *achieve financial security*, for which she follows a procedure along the following lines:

- $\Pi :=$ EITHER (keep your money in your mattress) OR ((go long/the market heads up) AND (go short/the market heads down))

Note the following:

- – $\Pi | (\text{the market heads up}) =$ EITHER (keep your money in your mattress) OR (go long)
- $\Pi | (\text{the market heads down}) =$ EITHER (keep your money in your mattress) OR (go short)
- $\Pi | (\text{maybe the market heads up, maybe it heads down}) =$ (keep your money in your mattress)

If Speculating Sandra believed the market would head up, she would have the choice of keeping her money in her mattress or going long; Speculating Sandra believed the market would head down, she would have the choice of keeping her money in her mattress or going short. (I could enrich the apparatus with a story about optimization, but it is intricate enough already.) But given her uncertainty, neither of the conditionalized actions can be triggered, so the only reasonable action for Speculating Sandra is to keep her money in her mattress.

Assuming my model, I turn now to (P1): whenever Fred is motivated to open the door, the motivating psychological state is a state of following a procedure. I

⁴⁴Frankfurt, ‘Problem’.

assume that to acquire the motivation to open the door is to form an intention with the content *open the door*. If the model is correct, then at least some of the time, when Fred forms such an intention, he does so because a procedure he follows, given his beliefs, requires it. What are the alternatives?

Perhaps there is some parallel stream of practical reason, operating in a totally different way—but we should hope not, and I can see no reason to think there is. So all cases in which Fred forms an intention to open the door ‘instrumentally’, with the end of serving some more comprehensive action, involve direct motivation by a state of following a procedure.

So if there are counterexamples to (P1), they would stem from action that is not in service of some other action. What then are the ‘ultimate sources’ of motivation?

Perhaps sometimes Fred just opens the door ‘for its own sake’—but in that case, I suppose, nothing at all motivates him to form the intention to do so: he just forms it *ex nihilo*. So that would not be a counterexample.

Finally, perhaps sometimes Fred opens the door out of a *static* end—out of desire, or because it is a requirement of his religion, or to attain the good. Of course, in any such case, whether opening the door served that end would depend on how things are, so that doing so with good reason would require appropriate beliefs; and in any such case, what was required might be complex, or sequenced, or alternative, or conditionalized. If so, the range of instructions could be expanded to include triples representing that executing a certain procedure from a certain situation attains a certain static end. In the interest of theoretical economy, I am inclined to think this would be the right way to go. But then following a procedure would intervene between the intention and the static end.

2.2 Motivation and command

Now to (P2): the content of a command motivating Fred to open the door in a canonical situation is the content of the psychological state in that situation motivating Fred to open the door. I argue on the basis of a theory of command I find congenial: in brief, the state motivating Fred is the following of a procedure by a sort of ‘collective person’ composed at least of Fred and whoever issues the command; the aim of the command is to call attention to that state; so in that sense

the act of command has normative force transparent to that state, and its content, appropriately to its normative force, recapitulates the content of that state.

2.2.1 Terminology

Let me expand briefly on what I mean by (P2). My notion of *command* is intended somewhat expansively, to include not just ‘commands’ in a strict sense—those made under situations of dominance and subordination—but also a wide variety of ‘calls to action’ in circumstances that cross-cut considerations of authority. So if Sam and Ro are cooking together and Sam asks Ro to hand her a pot, I include that as a command; and if a bishop suggests to the Pope that he visit Southeast Asia, or a parish priest beseeches the Pope to speak out about poverty, I include those too as commands. I do not assume that all commands are linguistic, or even conventional: a subtle gesture, under the right circumstances, might be commonly interpreted as a command to cut the small talk and get down to business.

By a *canonical situation*, I intend to exclude cases that fall beyond ordinary bounds of transparent successful communication. On the recipient’s side, this requires acceptance of the command with good faith. On the issuer’s side, this requires ‘practical sincerity’. By analogy, lies masquerading as assertions create ‘defective contexts’⁴⁵ and are not expected to fall under the theory of assertion without further epicycles. Similarly, practical sincerity is incompatible with insincere or pretextual attempts at manipulation masquerading as commands, as well as threats or jibes with command-like form advanced outside of circumstances fit for legitimate command.

Next, I presuppose that in a canonical situation, when Fred is commanded to open the door, that command *has* content. The alternative would be that a command is just another event in the natural world: the view Stenius⁴⁶ labels the ‘prolonged-arms’ theory.⁴⁷ As Stenius notes, that is a ‘causal theory’ (258). But content should be brought in only when there is ‘normativity’ (perhaps just the

⁴⁵Stalnaker, ‘Assertion’.

⁴⁶Stenius, ‘Mood’, X.

⁴⁷‘Jill [commands Jack to bring her an apple]. This command is [perceived] by Jack, on whom it acts as a stimulus; he reacts to it by fetching an apple for Jill. By the intermediation of [the act of command] Jill’s stimulus has brought about an adequate reaction in Jack. Jill has, so to speak, prolonged her arms by means of [the act of command]’ (258).

norm of intelligibility); so I presuppose that a command to Fred to open the door bears normative powers.

Next, I presuppose that in a canonical situation, when Fred is commanded to open the door, he *is* motivated to do so: that there is some rational motive force behind his forming the intention to open the door. Otherwise, Fred would just form the intention to open the door ‘for its own sake’: the command would be a Manchurian Candidate-esque trigger *causing* Fred to form the intention, which from Fred’s point of view would come from nowhere. This presupposition conforms to my sense of what ordinary command situations are like, and I hope also to the reader’s.

2.2.2 Social procedures

But if so, *what* motivates Fred to open the door when Sam commands him to do so—what is the psychological explanation of Fred’s forming the intention to open the door? There are two questions: whose state of mind provides the psychological explanation; and which sort of attitude is involved. I take them in order.

It cannot be an attitude of Sam’s that provides the explanation. The success-condition of any of Sam’s intentions imposes constraints only on *Sam’s* behavior. Intentional control of behavior is in that sense ‘agent-internal’.

Nor can it be an attitude of Fred’s that provides the explanation: perhaps Fred’s desire to keep Sam happy, or to secure blandishments for himself.⁴⁸ If so, Fred thinks of Sam’s command as just another event in the natural world: a signal he interprets as prudentially recommending a certain response, as a thunderclap would recommend running for cover. But then we should no more assign content to Sam’s command than to a thunderclap.

(Lewis, following Stenius, obscures this point by treating only *linguistic* commands: the conventional usage of expressions in a language is perhaps reason to assign them content, which might then be derivatively assigned to speech acts using them. But Lewis and Stenius both treat artificial languages with stipulated conventional usages. In the dialectic of this article, it is the content of natural language that is up for grabs; my approach attempts to extract that from the content

⁴⁸Lewis, ‘Problem’, 22.

of command. Because command need be neither linguistic nor conventionalized, the notion of the content of a command has a language-independent significance.)

But if neither Sam's nor Fred's attitude provides the motivation, whose does? I propose that it is the attitude of a *social agent* into whom Sam and Fred have agreed to 'socialize' themselves: I label this entity *Sam-plus-Fred*. For Sam and Fred to socialize into Sam-plus-Fred is roughly for them to establish a joint product or a joint interest. It is under circumstances in which several people have socialized into a social agent that legitimate commands may be given by one of them to the other. Circumstances that are 'canonical' for command therefore require a social agent.

The psychology of a social agent is much like that of a *natural agent*, like Sam or Fred: in particular, the success-condition of Sam-plus-Fred's intentions imposes constraints on the behavior of Sam-plus-Fred. But the behavior of Sam-plus-Fred is constituted by the behavior of Sam and the behavior of Fred (and their relations to one another), and Fred's (Sam's) behavior is ultimately constrained by the success-conditions of his (her) own intentions. So an intention of Sam-plus-Fred, if it is to be realized, must constrain the intentions of Sam or of Fred.

How so? Well, by (P1), we know that Fred forms (non-groundless) intentions in response to procedures that are being followed. So if Sam-plus-Fred's intention constrains Fred's intention, it does so by Sam-plus-Fred following a procedure. This procedure is followed in service of a social intention of Sam-plus-Fred's. So, canonically, Sam commanding Fred to open the door motivates Fred to open the door *in service of their social intention*: he is acting not for himself, nor for her, but for them.

2.2.3 The aim of command

Procedures are structured entities. If a natural agent follows a procedure, the procedure is 'de se': it does not pick out a subject, because its only effect can be to adjust the intentions of the person who is following it. A social agent can also follow any de se procedure: if so, doing so adjusts its own intentions. But it can also follow procedures that devolve intentions to its participants: such a procedure must contain a programmatic marker denoting the participant to whom the intention devolves (no such procedure can be followed unless the person denoted does

in fact participate in the social agent). So, for example, if Fred is commanded to open the door, the content of that command would be a procedure like (12):

12. \langle Fred, *open the door* \rangle

If Sam-plus-Fred follows (12), that normatively constrains Fred. For then Sam-plus-Fred is in a defective state unless Fred intends to open the door. To socialize into Sam-plus-Fred is for Sam and for Fred to avoid collapsing Sam-plus-Fred into defectiveness. So if Sam knows Sam-plus-Fred is following (12), she needs to call this to Fred's attention so that he too might be aware of this; and if Fred is aware of this, he needs to form intentions as appropriate to the structure specified in (12)—namely, to form the intention to open the door.

On this view, the 'point' of command is to put on display the following by a social agent of certain procedures, so that those bound by them might form intentions to execute them. If so, we may say that the content of a command is the procedure the following of which is put on display in its issuance. A command can only be legitimately issued when there is such a procedure; and there can only be such a procedure when the issuer and recipient of the command are socialized—when they belong to a group voluntarily socialized to pursue joint ends (this explains the phenomenon, noted by Ninan⁴⁹ and taken up by Portner,⁵⁰ that me commanding the Pope would be absurd). Illegitimacy of a deep sort arises absent socialization: 'commands' backed up by threats are followed out of prudence and not because they highlight collective reasons. Illegitimacy of a shallow sort arises when there is dissembling: the self-serving boss purports to legitimacy, but the fact of socialization is a pretext rather than the source of a collective reason.

Recall (P2): the content of a command motivating Fred to open the door in a canonical situation is the content of the psychological state in that situation motivating Fred to open the door. This can now be seen as a consequence of the theory of command just advanced. Fred and Sam, in their canonical situation, socialize into Sam-plus-Fred. The content of Sam's command is that procedure Π Sam-plus-Fred follows which Sam attempts to put on display—namely, (12). Canonically, she succeeds, and Fred becomes thereby aware of Sam-plus-Fred's

⁴⁹Ninan, 'Two puzzles', 21.

⁵⁰Portner, 'Imperatives and modals', 366n12.

following (12). Because Fred participates in Sam-plus-Fred, his motivation to conform to Sam-plus-Fred's following (12) is thereby activated. But that conformity is just forming the intention to open the door. So the state motivating Fred to open the door is Sam-plus-Fred's following (12)—the content of which, of course, is (12). So (12) is both the content of the command and the content of the motivating state—in accord with (P2).

2.3 Command and imperative sentence

Now to (P3): for any c and any canonical situation represented by c , $\llbracket(11)\rrbracket^c$ is the content of a command performed with (11) in that situation. (Recall that (11) is 'Fred open the door!': a command performed with (11) is therefore a command to Fred to open the door, which by the argument of the previous subsection has content (12).)

2.3.1 A pragmatic basis for semantics

I will be especially brief here, as the case runs by analogy to a familiar 'Classical' theory of assertion.⁵¹

On that Classical picture, conversational situations are represented by⁵² sequences of parameters known variously as 'conversational scores'⁵³ or, in my preferred terminology, *contexts*.⁵⁴ Any context c determines its *context set* i_c : a proposition representing exactly that increment of information commonly presupposed among the participants to the conversation (each presupposes that ... each presupposes that increment). Speech acts are interpreted by contexts: a declarative sentence φ generally has its content not absolutely, but only interpreted against c ;

⁵¹Lewis, *Convention*; Lewis, 'General semantics'; Lewis, 'Languages and language'; Lewis, 'Scorekeeping'; Lewis, 'Index'; Stalnaker, 'Pragmatics'; Stalnaker, 'Indicative conditionals'; Stalnaker, 'Assertion'; Stalnaker, 'Representation'; and Kaplan, 'Demonstratives'; Kaplan, 'Afterthoughts'. Disclaimer: for simplicity and brevity, the picture I describe is my favorite way to cut the cloth among the (significant) disputes among these philosophers over how to implement the broadly agreed-upon programmatic vision; there are elements of the picture as I describe it for each to disagree with.

⁵²I will generally 'abuse notation', conflating contexts with the situations they represent.

⁵³Lewis, 'Scorekeeping'.

⁵⁴Stalnaker, 'Pragmatics'.

‘the content of φ interpreted against c ’ is, again, abbreviated $\llbracket\varphi\rrbracket^c$. Speech acts also adjust parameters of context. In particular, if an assertion of φ is accepted into a prior context c generating a posterior context $c + \varphi$, the *essential effect* of this is to update the prior context set i_c to a posterior context set $i_{c+\varphi} = i_c \cap \llbracket\varphi\rrbracket^c$. That, finally, requires that $\llbracket\varphi\rrbracket^c$ be a proposition.

(Objection.⁵⁵ Don’t conflate *content* and *semantic value*: content is pragmatic and psychological as discussed; but semantic value must be compositional. Suppose $\llbracket\text{somewhere(it’s raining)}\rrbracket^c$ is a proposition. But Contextualist Compositionality requires that $\llbracket\text{somewhere(it’s raining)}\rrbracket^c = \llbracket\text{somewhere}\rrbracket^c(\llbracket\text{it’s raining}\rrbracket^c)$; and that requires a free parameter in $\llbracket\text{it’s raining}\rrbracket^c$; so $\llbracket\text{it’s raining}\rrbracket^c$ is not a proposition. So if pragmatics and psychology require the content of φ against c to be a proposition, $\llbracket\text{it’s raining}\rrbracket^c$ is distinct from the content of ‘it’s raining’ against c .)

Reply: I have already rejected Contextualist Compositionality for Repair Compositionality, so I am unmoved by insistence on Contextualist Compositionality (and Lewis’s reason to accept Contextualist Compositionality is unlikely to convince many—namely, that there is no further significance to a semantic theory beyond its instrumental use by theorists in systematizing conventions of language;⁵⁶ compare ‘If a grammar is to do its jobs as *part of a systematic restatement of our common knowledge about our practices of linguistic communication*, it must assign semantic values that determine which sentences are true in which contexts’).⁵⁷ Next, there is arguably strong empirical motivation⁵⁸ for a noncompositional ‘wrap’ operation to handle *extraposition* (‘what do you think they did *that upset everyone?*’). Directly on the argument at hand: something deserving the name ‘compositionality’ seems to be preserved if $\llbracket\text{somewhere(it’s raining)}\rrbracket^c = \llbracket\text{somewhere}\rrbracket^c(\lambda c \llbracket\text{it’s raining}\rrbracket^c)$, which requires no free parameter in $\llbracket\text{it’s raining}\rrbracket^c$; alternatively, perhaps psychology and pragmatics would go better if presuppositions or belief-states contain free parameters.)

A theory of command analogous to this theory of assertion would run as follows. Any context c in which commands can legitimately be given determines

⁵⁵Lewis, ‘Index’; Rabern, ‘Against’; Yli-Vakkuri, ‘Propositions and compositionality’; Yalcin, ‘metasemantics’.

⁵⁶Lewis, ‘Languages and language’, 175–8.

⁵⁷Lewis, ‘Index’, 21, my emphasis.

⁵⁸Dowty, ‘Compositionality’.

its *implementation state* m_c : a set containing exactly those procedures commonly recognized to be followed by the social agent in which the parties to the conversation participate (each recognizes that ... each recognizes that the social agent follows those procedures). Speech acts are interpreted by contexts: an imperative sentence α generally has its content not absolutely, but only interpreted against c ; ‘the content of α interpreted against c ’ is, again, abbreviated $\llbracket \alpha \rrbracket^c$. Speech acts also adjust parameters of context. In particular, if a command of α is accepted into a prior context c generating a posterior context $c + \alpha$, the *essential effect* of this is to update the prior implementation state m_c to a posterior implementation state $m_{c+\alpha} = m_c \cup \{\llbracket \alpha \rrbracket^c\}$. That requires that $\llbracket \alpha \rrbracket^c$ be a procedure. In particular, because the characteristic update to m_c resulting from acceptance of a command with (11) is to introduce to it a social procedure calling on Fred to open the door, $\llbracket (11) \rrbracket^c$ is just that social procedure—in accord with (P3).

The argument is at bottom methodological. One thing we *might* ground the semantics of imperative sentences in is the pragmatics of command, as implemented within Classical structures.⁵⁹ To do so is to make a certain methodological choice; and that is a choice I have made. End of argument. Perhaps it suffices for present purposes to announce this, to establish the credibility of the choice by analogy with the Classical theory of assertion, and play out the string.

2.3.2 Imperative entailment?

Anyway, what might the alternative be—what else could be data for a theory of imperative semantics? The founding moment in natural language semantics⁶⁰ advanced the core data as *entailment* and *truth-conditions*, as we judge them. But while this approach has been fruitful for the analysis of declarative sentences, there are reasons to doubt its extensibility to imperatives.

First, there is no intuitive sense to be made of the truth-value of an imperative. No doubt, we can make sense of what it would be to *obey* an imperative. But the

⁵⁹On the *grounding*, I am in agreement with Portner, ‘Semantics of imperatives’; Starr, ‘Preference’; and Charlow, *Practical Language*; Charlow, ‘Logic and semantics’. On the Classicism, I am in agreement with Portner, ‘Semantics of imperatives’, though not with Portner, ‘Imperatives and modals’, Starr, or Charlow, who prefer the ‘dynamical’ approach to semantic theorizing associated with Heim, ‘Projection’ and Veltman, ‘Defaults’.

⁶⁰Montague, *Formal Philosophy*.

phenomenon of obedience is sociable and not fundamentally linguistic—so this offers no alternative to the approach I recommend.

And second, imperative entailment is poorly-behaved. I grant that in some reasonable sense, all of the (13) look something like entailments:

13. (a) Don't refrain from opening the window! \vdash Open the window!
- (b) Open the window and close the door! \vdash Open the window!/Close the door!
- (c) Open the window!; Close the door! \vdash Open the window and close the door!
- (d) Open the window or close the door!; Don't close the door! \vdash Open the window!
- (e) If it is raining, take an umbrella!; It is raining. \vdash Take an umbrella!

Those all look like instances of familiar rules for declarative sentences: (a) negation elimination; (b) conjunction elimination; (c) conjunction introduction; (d) disjunctive syllogism; (e) modus ponens. Those rules—at least (a)–(d)—are arguably valid for declarative sentences because declarative sentences have propositional semantic values, because the propositions form a Boolean algebra, because the connectives have Boolean-algebraic operations as semantic values, and because entailment mirrors the precedence-relation in a Boolean algebra (or something slightly fancier). So perhaps imperatives have propositional semantic values?⁶¹

Unfortunately, (14) does not look like an entailment.⁶²

14. Post this letter! $\not\vdash$ Post this letter or drink up my wine!⁶³

⁶¹The anti-structure arguments of [Stalnaker](#), *Inquiry*; [Stalnaker](#), 'Mental' and [Lewis](#), 'Reduction of mind' do not provide an alternative rationale: both must distinguish theoretical and practical *attitudes*; my procedures are structured just out of the role they must occupy in my highly elaborated account of how these fit together.

Finally, Lewis is correct that 'the logical relations among the objects of the attitudes [] will be hard to describe if the assigned objects are miscellaneous' [Lewis](#), 134: it was indeed hard to come up with the theory discussed two subsections back. But now we have it, so the difficulty need no longer deter us!

⁶²For that matter, is (13a) a genuine entailment? Perhaps refraining from refraining from opening the window is just allowing oneself the option of opening the window.

⁶³[Ross](#), 'Logic and imperatives'.

But that is a counterinstance to disjunction introduction; and that rule is valid for sentences with propositional semantic values; so imperative entailment, if genuine, does not mirror the precedence relation in a Boolean algebra—and if not, it is obscure what imperative entailment might be, and what might constrain a theory of imperative semantic values.

It remains a nice question how to describe the ‘entailment-like’ phenomena tracked in (13)–(14). The first step would be a compositional semantics for imperative sentences. If (P1)–(P3) are correct, semantic evaluation of an imperative sentence presumably would go by locating its procedural isomorph. An elemental imperative like (11) has a content like (12). Its negation, ‘Fred don’t open the door!’, has the content $\langle \text{Fred}, \langle \mathbf{Ref}, \textit{open the door} \rangle \rangle$. For a conjunctive or disjunctive imperative, $\llbracket \alpha \wedge \beta \rrbracket^c = \langle \mathbf{Con}, \llbracket \alpha \rrbracket^c, \llbracket \beta \rrbracket^c \rangle$; $\llbracket \alpha \vee \beta \rrbracket^c = \langle \mathbf{Alt}, \llbracket \alpha \rrbracket^c, \llbracket \beta \rrbracket^c \rangle$.⁶⁴

But how are these structured entities to undergird entailment-like phenomena? In my view (section 4), these reflect the underlying ‘static pragmatics’ of command: whenever the ‘premisses’ are accepted in a context, so is the ‘conclusion’. Those in turn are consequences of the theory of practical rationality.

Consider conjunction elimination (13b): following a procedure to open the window and close the door requires forming the intention to open the window and forming the intention to close the door. But the same is true for following a procedure to open the window and following a procedure to close the door. So, in their effect on intention, following the conjunctive procedure and following both its conjuncts are indiscriminable. Since anyone following both conjuncts follows each, someone following the conjunctive procedure cannot be discerned not to be following one of the conjunct procedures.

Consider disjunctive syllogism (13d): following a procedure to open the window or close the door requires either forming an intention to open the window or forming an intention to close the door. But following a procedure to not close the door requires forming an intention to act only in ways incompatible with closing the door. Because we believe we will carry out our intentions, one cannot carry

⁶⁴Negation does not seem to take scope over the subject of an imperative, though the binary connectives do: the ungrammaticality of *‘don’t Fred open the window!’ parallels the apparent nonsensicality of calling for action of some sort from someone unless the person is Fred and the action is opening the window; by contrast, calling for positive action of some sort from both Fred and Brent or from at least one of them appears fine, in parallel with the grammaticality of ‘Fred open the door and Brent open the window’ and ‘Fred open the door or Brent open the window’.

both an intention to close the door and an intention to act only in ways incompatible with closing the door. So following the disjunctive procedure requires forming an intention to open the window.

Consider disjunction introduction (14): following a procedure to post this letter requires forming an intention to post this letter. Following a procedure to post this letter or drink up my wine requires either forming an intention to post this letter or forming an intention to drink up my wine—perhaps whichever of these is apparently for the better. So one who follows the disjunctive procedure and to whom the latter appears better will form an intention to drink up my wine. But even if one is following a procedure to post this letter and it appears better to drink up my wine than to post this letter, it does not follow one forms an intention to drink up my wine: even if better, drinking up my wine might be incompatible with whatever else one has set about doing. So if one is following a procedure to post this letter, one can still be discriminable from one who is following a procedure to post this letter or drink up my wine.⁶⁵

2.3.3 Imperatives, declaratives, and connectives

Why, in light of their differing meanings, do we use the same connectives for imperatives as for declaratives? —Imperative and declarative sentences are complex; granting semantic values of type π for imperatives and of type p for declaratives, how they compose differs (more on this starting next section). So perhaps there is no difference in the semantic values of the connectives in application to imperatives and declaratives: I have not said what **Ref**, **Alt**, and **Con** are, so they may well just be *complementation*, *union*, and *intersection*, respectively. Indeed, the \mathcal{X} -function mapping a procedure to the action-kind it executes is central to the functioning of practical rationality; under the \mathcal{X} -function, **Alt** and **Ref** do indeed act as *union* and *complementation*, while **Con** acts more or less as *intersection*.

⁶⁵The Ross paradox is widely discussed: see **Portner**, ‘Imperatives’ for references. The approach sketched here is developed into a proper semantical treatment in **Hellie**, ‘Motivation and modality’: roughly, procedural contents are sets of sets of intentions, each set of intentions representing an alternative; these contents are subject to certain closure conditions. Operations of conjunction and disjunction can be defined over sets of sets subject to those closure conditions, and along with them an ordering: conjunction behaves classically, disjunction *eliminates* classically but *introduces* in accord with the Ross paradox; and negation is undefinable.

So I am not convinced my approach predicts any problematic difference in meaning.⁶⁶

2.4 Imperative sentence and uninflected clause

Now to (P4): $\llbracket(11)\rrbracket^c = \llbracket(6)\rrbracket^c$ —more generally, the semantic value-profile of an uninflected clause (like (6), ‘Fred open the door’) is just that of its corresponding imperative sentence (like (11), ‘Fred open the door!’). The following argument would support (P4): (11) and (6) are the same expression; Leibniz’s Law says that whatever is so of a is so of anything identical to a ; so (11) and (6) have the same semantic value-profile.

Why believe the first, empirical premiss? Going by superficial appearances, (11) and (6) are the same expression. But going by superficial appearances in the domain of syntax is risky business. One expression could contain ‘covert’ constituents not present in the other. Or the expressions could contain the same constituents but be composed differently. Either prospect would preserve superficial appearances. Whether either prospect is realized is an empirical question, of course. But there seems to be reason to doubt either is.

Does either of (11) and (6) contain covert material absent from the other? According to a venerable theory of imperative syntax, an imperative sentence contains a covert ‘mood’ marker—which would be absent from the corresponding uninflected clause. But the cross-linguistic investigations of Portner and colleagues⁶⁷ turned up no evidence of any covert mood marker.

Are (11) and (6) composed differently? One might think that the occurrence of ‘Fred’ in (11) is not in semantic combination with the verb phrase, but is only

⁶⁶Conditionality provides empirical motivation independent of the argument from (P1) and (P2) for assigning procedure-type semantic values to imperatives inside of a broadly ‘pragmatics-driven’ approach. Portner, 249n11 recognizes that the ‘force of [a conditional imperative] is to place the main imperative clause’s property [] onto the addressee’s To-Do List only once the *if* clause [] is true. What is difficult is to find a way of implementing this which fits with the semantics of conditionals generally’. A ‘To-Do-List’ would be something like a set of intentions for a party to the conversation. But intentions do not suffice for managing conditionality: for that, we need procedures and following—again, for reasons stemming from the phenomenon discussed in Kolodny and MacFarlane, ‘Ifs and oughts’.

⁶⁷Portner, ‘Semantics’

used *vocatively*, to hearken Fred’s attention to the speech act to follow, in which the uttered sentence is just (15)—as in ‘hey Fred: open the door!’:

15. Open the door!

But in ‘hey you guys: the last one out turn out the lights’⁶⁸, ‘hey you guys’ is vocative. Is ‘the last one out’ also vocative? If so, it would not do anything: everyone whose attention is to be drawn has already been drawn; moreover, no one knows who will be last out, so it is unclear whose attention is to be drawn. And yet ‘hey you guys: turn out the lights’ has a different meaning, so ‘the last one out’ makes a contribution to meaning—so it is not vocative. For this reason, and others⁶⁹, it is generally agreed that an imperative has a subject, so that ‘Fred’ in (11) is in fact the semantic subject of the imperative sentence.

This is the premiss in the case for (A) about which I feel least confident. If it is false, the explanation of the Obligation–Aspect Effect can be adjusted as follows. Rather than asserting that uninflected clauses just are imperative sentences, I would assert that ‘must’ can take either an uninflected clause or an imperative sentence as its argument. The two readings of (1) would be due to an ambiguity, with the obligative reading resulting from an imperative argument and the epistemic reading resulting from an uninflected-clause argument. The difficulty in accessing the epistemic reading stems from its requirement of type-repair, contrasting with the lack of type-repair involved in the obligative reading—in line with (OA-i). I would then observe that no imperative sentence can be inflected:

16. (a) * Fred be opening the door!
(b) * Fred have opened the door!
(c) * Fred have been opening the door!

And as a result, the modals in (2) cannot have imperative arguments, and therefore cannot have obligative readings—in line with (OA-ii).

⁶⁸McCawley, *Syntactic*.

⁶⁹Portner, ‘Semantics’.

3 Temporal perspective

According to principle (B), the progressive and perfective aspect map *eras* into *eras*, while present and past tense map *eras* into *propositions*. (Recall that an era is a function from worlds to temporal (open) intervals.) I will now explain and justify this doctrine, and also explain the functioning of the type-repair operation $[r|\pi]$ by which the procedure-type semantic value of an uninflected clause is lowered to the era-type semantic value that is a candidate operand for tense (thereby providing part of the justification for (D-i)). I do so by laying on the table and then briefly defending an approach to the semantics of temporal perspective I call the *RSTU theory*.

But first: why do we need another theory of temporal perspective, among the great many on the market?⁷⁰ Mine has these advantages. It is unified, providing a compositional semantics for all eight options for temporal perspective in English, and interfacing relatively neatly when tense morphology is captured by a modal. It is in spirit not significantly different from the very first unified theory of temporal perspective in the natural language semantics tradition, that of Bennett and Partee⁷¹—though I have recast the spirit in a more modern package—so that in a sense it captures the ‘obvious’ approach, lending it *prima facie* plausibility. The RSTU theory makes temporal perspective *user-friendly*: in my view, temporal perspective is just about shifting around points and intervals—operations we can all easily perform; this user-friendliness is abetted by the various *symmetries* in the approach. The theory makes temporal perspective *topic-neutral* and *metaphysically light*.

3.1 The RSTU theory

The RSTU theory is so-called because of the pride of place it affords to *Reference* and *Speech Moments* and *Topic* and *Underlying Eras*. The approach embeds a number of symmetries:

- The S and U components are so-to-speak ‘real’, whereas the R and T components are so-to-speak ‘virtual’;

⁷⁰Portner, ‘Perfect and progressive’.

⁷¹Bennett and Partee, ‘Toward’.

- The *tenses* (PRES and PAST) are about the location of the R-moment relative to the T-era, whereas the *aspects* (prog and perf) are about the extraction of the T-era from the U-era;
- PAST and perf are both about *following* their operand, whereas PRES and prog are both about being *embedded within* their operand.

The general frame, then, is this: the tenses output a proposition concerning how the Reference-moment (selected anaphorically as a result of past events in the conversation, with the generally salient Speech-moment available as a weak default when no other basis for finding an R-moment can be advanced) relates to the Topic-era. The T-era, in turn, is produced by the action on the Underlying-era of both, either, or neither of the aspects. And the U-era is produced by the action of type-lowering on the procedure-type semantic value of the uninflected clause.

The RSTU theory has its antecedents in the venerated Reichenbach⁷² approach to temporal perspective, and in its intervallic modernization by Bennett and Partee.⁷³ But where Reichenbach uses only moments and Bennett and Partee use only intervals, what is needed are both.

Bennett and Partee came to abandon their approach on the grounds that it was ‘demonstrably wrong’.⁷⁴ The alleged problem was the ‘imperfective paradox’: the phenomenon, to be discussed in section 3.2.2, on which we are comfortable saying things like ‘Otis was crossing the street when he had a heart attack and died; Otis would never cross the street’. If we take this seriously, that makes aspect much harder to deal with. For if, even when the street goes uncrossed so that ‘cross the street’ applies to no actual (relevant) thing, it can be true to say that someone was *crossing* the street, making contact with the meaning of ‘cross the street’ can appear to require either reaching outside of actuality or loading actuality up with metaphysical clutter. Fortunately, we do not need to face the imperfective paradox: as I will argue, it is better interpreted as a phenomenon of discourse than of semantics.

⁷²Reichenbach, *Elements*.

⁷³Bennett and Partee, ‘Toward’.

⁷⁴Bennett and Partee, ‘Toward’, 107–8.

3.1.1 R, S, and T

Now in more detail. Where (t, t') is a temporal open interval, let $(t, t') \leq t'' := t' \leq t''$. Let, moreover, a context c determine a moment of time t_c , the R-moment; if c represents a conversational stage, let t_c be the time that is ‘commonly salient’ among parties to the conversation. Then:

17. Semantics of tense

- (a) $\llbracket \text{PRES} \rrbracket^c = \lambda E \{w : t_c \in E(w)\}$
- (b) $\llbracket \text{PAST} \rrbracket^c = \lambda E \{w : E(w) < t_c\}$

As announced, the operand of tense is the T-era, which is in turn the U-era as aspectually-modified (if at all). As announced, the perfective acts on its operand by returning a value just following the operand, while the progressive acts on its operand by returning a value embedded in the operand. Let $(a, b)_\bullet = a$ and $(a, b)^\bullet = b$. Then:

18. Semantics of aspect

- (a) $\llbracket \text{prog} \rrbracket^c = \lambda E E^\circ$ where $E(w)_\bullet < E^\circ(w)_\bullet < E^\circ(w)^\bullet < E(w)^\bullet$
- (b) $\llbracket \text{perf} \rrbracket^c = \lambda E E^+$ where $E(w)^\bullet = E^+(w)$.

I should highlight that these clauses are not supposed to be strict rules, but instead establish constraining frames to which any use of an aspect-laden sentence must conform: in (a), the value of $E^+(w)^\bullet$ is left open for further determination; as are, in (b), the exact values of $E^\circ(w)_\bullet$ and $E^\circ(w)^\bullet$.⁷⁵

⁷⁵The RSTU approach is at least superficially somewhat similar to an ‘orthodox’ approach due to Kratzer, ‘More’. As I understand it (papering over various side-issues regarding intensionality), that view extracts a U-era from an event supplied by the verb phrase, compares the U-era to an R-era using aspect, and then locates the S-moment relative to the R-era using tense—where the location of the S-moment relative to the R-era is a *presupposition*, in the sense of a condition on interpretability, rather than a contributor to content. On the specifics, past tense presupposes the S-moment *follows* the R-era, while present tense presupposes the S-moment is *within* the R-era; and perfective aspect entails the R-era surrounds the U-era, while progressive entails the U-era surrounds the R-era. Unpacking all this, tense has no semantic effect; all the semantic work is done by aspect, so the approach permits really just two possibilities: the U-era is within the R-era;

3.1.2 Type-lowering

As announced, the T-era emerges from the U-era, which is the type-lowering of the semantic value of the uninflected clause: the underlying era in any of the tensed example sentences (4) and (5)—‘Fred opens/opened the door.’ and so forth—is $[r|\pi][[(6)]^c = [r|\pi](12)$; namely, as argued in the previous section, $[r|\pi]\langle \text{Fred}, \textit{open the door} \rangle$. How does this type-lowering work?

I propose $[r|\pi]\Pi$ is calculated in two stages. First, an action-kind is extracted from Π by the application of the fundamental \mathcal{X} -operation. But an action-kind is not yet an era: an action-kind is a relation among worlds, intervals, and individuals; whereas an era is a function from worlds to intervals. Getting rid of the individual is straightforward: $\mathcal{X}\langle \text{Fred}, \textit{open the door} \rangle$ is the set of $\langle w, I, \text{Fred} \rangle$ such that in w , Fred opens the door over I . The individual-argument provides no further information, and can be dropped.

So somehow, the many intervals over which Fred opens the door in w must be compressed to one. Two approaches stand out. The first *aggregates* all of the little intervals, or a great many of those which are ‘salient’, into a big interval commencing with the earliest little interval and concluding with the latest little interval. Something like that seems likely to be involved in *habitual* readings, which are possible for any of the eight combinations of tense and aspect. The second approach takes a *cross-section* from among the many little intervals, stripping out those which have some salient feature: perhaps those which unfold over a stretch closest to the present. Something like that is surely what happens for *narrative* or otherwise *specific* readings, again possible for any of the eight combinations of tense and aspect. Then:

the R-era is within the U-era.

Kratzer may be correct about the involvement of presupposition; I leave that for future investigation. But I have some worries. First, too much privilege is given to the S-moment: language allows us to shift around our reference point wherever we wish. Second, ‘Fred has made dinner’ has its presupposition met if the S-moment is during the R-era, and is true if the R-era surrounds the U-era. It is not in conflict with the presupposition being met and the sentence being true that, at the S-moment, Fred has not yet started making dinner. I do not see how I could sensibly and truly assert ‘Fred has made dinner’ if Fred has not started making dinner. Third, the simple past/present surely exists, and at least in English has meanings distinct from any of the aspectually modified forms (and the meanings of simple past and present differ); but if tense is merely presuppositional, I do not see how the simple forms could say anything sensible. Fourth, the perfective and the progressive are represented as an exclusive alternation, but English contains a perfective progressive.

19. Type-lowering: era-from-procedure

(a) Specific

$\langle w, I \rangle \in [r|\pi]\Pi$ just if I is the maximally salient member of $\{I' : \exists j \langle w, I', j \rangle \in \mathcal{X}(\Pi)\}$

(b) Habitual

$\langle w, I \rangle \in [r|\pi]\Pi$ just if $I_{\bullet} = \inf\{I'_{\bullet} : \exists j \langle w, I', j \rangle \in \mathcal{X}(\Pi)\}$ and $I^{\bullet} = \sup\{I'^{\bullet} : \exists j \langle w, I', j \rangle \in \mathcal{X}(\Pi)\}$

Again, these are not supposed to be thought of as strict rules, but as ‘local minima’: obvious, cognitively undemanding strategies that leap out at us among the many ways to do the job of era-from-procedure type-lowering. That job is just to extract an era from a procedure. The \mathcal{X} -operation leaps out as a presumptive candidate for first contact with the procedure: for converting it into an appropriately ‘structureless’ entity. The *specific* and *habitual* strategies are then straightforward ways of converting an action-kind into an era. (As should be obvious, both stages involve abstraction of structure which cannot be retrieved afterward, so that there cannot be any conservative form of procedure-from-era type-raising—in accord with part of (D-i).)

3.1.3 Predictions

Assuming throughout the specific rather than habitual readings, here are the RSTU theory’s predictions for (4) (‘Fred opens/opened the door’) and the (5) (‘Fred is/was opening the door’ and so forth). Simple present/past: the proposition that the reference time (R) is during/follows the interval (T = U) of the salient door-opening by Fred. Present/past progressive: the proposition that the reference time (R) is during/follows a salient interval (T) entirely contained within the interval (U) of the salient door-opening by Fred. Present/past perfective: the proposition that the reference time (R) is during/follows a salient interval (T) immediately following the interval (U) of the salient door-opening by Fred. Present/past perfective progressive: the proposition that the reference time (R) is during/follows a salient interval (T) immediately following a salient interval (T⁻) entirely contained within the interval (U) of the salient door-opening by Fred (here T⁻ an intermediate interval determined by the progressive and handed off to the perfective).

3.2 Favorable phenomena

Why believe the RSTU theory? Here I must procede with regrettable haste. I base my discussion on Portner’s recent survey of the progressive and perfective:⁷⁶ examples and the phenomena they exemplify either taken directly from Portner or subtly modified; analysis of course mine.

3.2.1 Perfective progressive

At the outset, note that each theory on Portner’s menu treats either the perfective or the progressive in isolation from the other: none attempts to treat the perfective progressive. But it would surely be desirable to do so—as the RSTU theory does, and without any ad hocery or grinding of gears. And it also represents a striking symmetry between the aspects—unavailable through applying a ‘one from column A, one from column B’ approach to Portner’s menu.

Note in particular this consequence of the RSTU theory: $\llbracket \text{perf} \rrbracket^c(\llbracket \text{prog} \rrbracket^c(E)) = E^{\circ+}$ is such that $E(w) < E^{\circ+}(w)_{\bullet} < E(w)^{\bullet}$ —but the relative position of $E(w)^{\bullet}$ and $E^{\circ+}(w)^{\bullet}$ is left undetermined. That is congenial: ‘Brent has/had been whipping the cream’ can be advanced if one thinks he is still at it, or if one thinks he has finished, or if one is uncertain.

3.2.2 Progressive

Regarding the progressive, Portner highlights a number of important phenomena for a theory to accommodate;⁷⁷ I remark on some of these. First, Portner dubs as the ‘no-statives property’ the unacceptability of progressivizing (some) stative sentences, as in *‘she was knowing the answer’. If no U-era can be extracted from the uninflected ‘she know the answer’, the progressive cannot find a T-era embedded in it. Arguably a stative uninflected clause determines only a relation between worlds and times, and not between worlds and intervals; if so, there is no U-era within which to embed a T-era. Still, ‘she has known the answer’ seems better. Why the contrast? (18b) requires only a concluding moment from the object it modifies rather than an interval of time; perhaps it takes less cognitive

⁷⁶Portner, ‘Perfect and progressive’.

⁷⁷Portner, ‘Perfect and progressive’, 3.1.1.

gymnastics to anchor the onset of the T-era at a point than to embed a T-era in a point.

Second, verb phrases of ‘activity’-type (*run*) famously contrast with those of ‘accomplishment’-type (*run around the block*): ‘Fred is running’ entails ‘Fred has run’, but ‘Fred is running around the block’ does not entail ‘Fred has run around the block’. I put this up to a distinction in action-kinds: for K an activity and $I' \subseteq I$, if $\langle w, I, j \rangle \in K$, then $\langle w, I', j \rangle \in K$ —activities are *pervasive*; but for K^* an accomplishment and $I' \subsetneq I$, if $\langle w, I, j \rangle \in K^*$, then $\langle w, I', j \rangle \notin K^*$ —accomplishments are *exclusive*.

If the R-moment is certainly in a T-interval⁷⁸ output by ‘Fred be running around the block’, then the R-moment is certainly in a U-interval extracted from ‘Fred run around the block’. But that U-interval may be the earliest known interval in which Fred runs around the block; in which case there is no way to embed the R-moment in a T-interval certainly following any alternative such U-interval.

Suppose the R-moment is certainly in a T-interval I output by ‘Fred be running’. Because I is strictly embedded in the U-interval extracted from ‘Fred run’, there is some subinterval I' strictly within that U-interval but prior to I . But the action-kind *Fred run* is an activity, and thus pervasive, so that prior subinterval I' is also a member of *Fred run*. So I' is a U-interval extractable from *Fred run*; so I is a T-interval just following that U-interval, potentially output by ‘Fred have run’; and because the R-moment is within I , we accept ‘Fred has run’.

Third, most of Portner’s phenomena concern the ‘imperfective paradox’: allegedly, there is no problem with discourses like this sad story: ‘Stan was crossing the street when he dropped dead from a heart attack; Stan never made it across the street’. As noted, Bennett and Partee were led to abandon their early approach to the progressive by their seriousness about the imperfective paradox. The paradigm for much later work was set by Dowty:⁷⁹ the progressive is a necessity modal which looks out to ‘inertial worlds’ where things go on their normal way uninterrupted. Szabo⁸⁰ recounts the challenges this approach has faced over the years in making good on its notion of an ‘inertial world’.

⁷⁸‘Certainly’ washes out the need to speak of functions from worlds to intervals, so for simplicity I discuss intervals rather than eras.

⁷⁹Dowty, ‘Toward’.

⁸⁰Szabó, ‘On’.

Why struggle and strive? A reason to avoid doing so is that semantic theories are about the understanding of ordinary language users (so the structures theories postulate should generally be easy to use) and must somehow accommodate the great flexibility of temporal-perspectival meaning (so the structures they postulate should generally be extremely ‘high category’). The modalization of the progressive does not seem promising on either score.

Struggling and striving is not hard to avoid, in this case: we need just not take the imperfective paradox seriously. My account says the sad story is strictly and literally inconsistent: ‘Stan was crossing the street’ is only acceptable if the R-moment is certainly within a subinterval of an interval belonging to the action-kind *Stan cross the street*; but an interval belongs to that action-kind only if, over it, Stan crosses the street.

And why not? First, recast the sad story in the present tense: ‘Stan is crossing the street and he will never cross the street’—bizarre, to my mind; a straightforward explanation is that the present makes the cognitive gymnastics needed to understand the sad story harder to perform. Second, it is easy to imagine what those might be: at the start of the discourse, we embrace Stan’s perspective, and from it think of him as he did, as crossing the street; of course, when he drops dead, we must shift perspective, but in so doing we take away what we learned perspective-neutrally from our jaunt into Stan’s perspective—much as we do whenever matters of intentional action or other psychological facts come up for discussion. Finally, intentional agency seems required in order for stories of interruptions to make sense. For contrast: ‘the garbage bag from the outskirts of Rome was drifting here and there on the winds to land in the center of the Trevi Fountain when it was snagged on a tree before even reaching the ring road; there it slowly decayed with the seasons, and never reached the center of the Trevi Fountain’. This seems absurd: why the Trevi Fountain rather than the pinnacle of Trajan’s Column, or anything else? Without intention, there is nothing to distinguish these options.

3.2.3 Perfective

Regarding the perfective: a central phenomenon Portner highlights is the distinction between ‘continuative’ and ‘noncontinuative’ uses—for instance, ‘Mary has eaten dinner’ versus ‘Mary has been eating dinner’. This falls out of my account of

the activity/accomplishment contrast. (Examples like ‘Mary has lived in London’ can be subsumed: *living in London*, unlike merely *being in London*, is arguably an activity and not a mere state.)

Next, in Portner’s view ‘the most famous property of the English present perfect’ is its ‘incompatibility with past time adverbials’: *‘John has arrived yesterday’—in contrast with the compatibility of the past perfect with past time adverbials: ‘John had arrived yesterday’. On the RSTU theory, this may stem from the adverbial’s application to the T-era—which cannot be yesterday if it *contains* the R-moment set to the S-moment, but *can* be yesterday if it *precedes* the R-moment set to the S-moment.

To capture several other phenomena, note that the RSTU theory distinguishes PAST α and PRES perf α as follows:

20. (a) $\llbracket \text{PAST } \alpha \rrbracket^c = \{w : ([r|\pi]\llbracket \alpha \rrbracket^c)(w) < t_c\}$
 (b) $\llbracket \text{PRES perf } \alpha \rrbracket^c = \{w : t_c \in ([r|\pi]\llbracket \alpha \rrbracket^c)^+(w)\}$

How do these differ? By (18b), $E(w)^\bullet = E^+(w)^\bullet$. So whenever $E(w) < t_c$, there is always *some* way to define a topic era E^+ such that $t_c \in E^+(w)$. But the topic era is given not by strict rules, but instead is something conversationalists flesh out within the constraints of (18). Accordingly, conversationalists who accept PAST α are still in a position to choose a topic era in such a way as to avoid accepting PRES perf α .

In particular, conversationalists will plausibly often choose a T-era with some ‘integrity’—one that is relatively short-lived, for example. Portner highlights the peculiarity of ??‘Gutenberg has discovered the art of printing’, in contrast with the acceptability of ‘now that Gutenberg has discovered the art of printing and Berners-Lee invented the internet, we Martians may enslave a civilized Earth’. Discourse-initially, it is hard to see the integrity of an interval of time containing both the 1450s and 2015, to the detriment of the first example; but the second example links the distant and recent past under an integrating march of civilization. Similarly, Portner suggests that ‘Mary has read *Middlemarch*’ ‘seems to indicate [] that this reading has affected Mary in some concrete way’—in contrast to the simple past ‘Mary read *Middlemarch*’. The ‘indication’, on the RSTU theory, stems perhaps from the requirement that something integrates the interval commencing with Mary’s just having read *Middlemarch* and continuing past the R-moment:

that interval's being just pervaded by some notable feature of Mary's is perhaps what integrates it. Similarly, Portner contrasts discourse-initial 'Einstein has visited Princeton' with 'Princeton has been visited by Einstein' and 'which Nobel Laureates have visited Princeton? —Einstein has visited Princeton, Feynman has visited Princeton . . .'. Einstein's having ceased to exist since the visit disintegrates the topic interval, when he is the topic of the sentence; but when Princeton is the topic of the sentence, its continued existence sentence sustains the integrity of the topic interval; and the same for the chain of visiting Nobel Laureates. Similarly for 'Kay has paid her bills this month/??this week/??today': 'given normal assumptions about one-month billing cycles', periods of other duration do not make for well-integrated topic intervals.

4 Modals

According to principle (C-i), modals map either *procedures* or *propositions* into *propositions*; according to (C-ii), the obligative reading of 'must' involves the modal's action on a *procedure* while the epistemic reading involves its action on a *proposition*. This final section justifies these doctrines, and explains the functioning of the type-repair operation [p|r] by which an era-type semantic value is lowered to a candidate propositional operand of the modal (thereby providing the remaining part of the justification for (D-i)). I do so by locating a semantics for 'must' within a more general overall approach to the 'logical' components of meaning I call *Mindset Semantics*.

I argue as follows. I introduce the term *ratify* as pertaining to the broad notion of 'acceptance' undergirding the logical notions of entailment and validity. Then:

- P1. Points of ratification are either worlds, which can ratify only propositions, or contexts, which can ratify both propositions and procedures
- P2. Modals quantify over points of ratification and operate on ratifiables
- P3. Either (a) modals do not quantify over worlds or (b) modals do not quantify over points of ratification

By (P1) and (P2), *either* modals quantify over worlds and operate on propositions *or* modals quantify over contexts and operate on propositions or procedures. But

by (P2) and (P3), modals do not quantify over worlds; so modals quantify over contexts and operate on propositions or procedures—the latter in line with (C-i). But then because a locally-restricted modal is co-ratified with its syntactic argument, locally-restricted (1) is equivalent to (11)—in accord with (C-ii).

Why accept the premisses? (P1) is neutral as between the Classical conception of entailment as truth-preservation⁸¹ and a more recent Informational conception of entailment as support- or ‘acceptance’-preservation.⁸² (P2) is Classically endorsed; and though (P3) is non-Classical, Yalcin has made a case I find compelling. Yalcin responds to (P3) by accepting disjunct (b) and rejecting (P2); fortunately, the cloth can be cut between the Classical and Informational conceptions by accepting disjunct (a) and affirming (C-i).⁸³

4.1 Logic and ratification

I begin by elucidating the place of *ratification* in an abstract analysis of the ‘logical’ phenomena of *validity* and *entailment*.

4.1.1 First principles

In broad terms, we say that a sentence σ is *valid* ($\vdash \sigma$) just if σ is ratified at every point, and that premisses τ_1, \dots, τ_n *entail* σ ($\tau_1, \dots, \tau_n \vdash \sigma$) just if σ is ratified at every point ratifying each of the τ_i . When $\sigma \vdash \tau$ and $\tau \vdash \sigma$, I write $\sigma \dashv\vdash \tau$.

The ratification of σ by r is internally complex: r ratifies σ by ratifying $\llbracket \sigma \rrbracket^r$, the semantic value of σ as interpreted at r : in that case I write $r \models \llbracket \sigma \rrbracket^r$ and $r \models \sigma$.

The \models -relation is a relation holding between points of ratification and arbitrary semantic values, so we might just as well ask whether $r' \models \llbracket \sigma \rrbracket^r$: in that case I write $r' \models^r \sigma$ —pronounced ‘ r' r -ratifies σ ’, and meaning that the semantic value of σ as interpreted at the point r is ratified by the point r' .

⁸¹Kaplan, ‘Demonstratives’.

⁸²Yalcin, ‘Epistemic modals’: compare Veltman, ‘Defaults’.

⁸³I am indebted to Yli-Vakkuri, ‘Comments’ for the observation that Yalcin’s strategy, recast roughly along the lines I describe in the body text, can be framed up in the two-dimensional ‘Kaplansque’ framework in the cloth-cutting way I describe, with contexts as points of ratification and Yalcin’s \Box interpreted as a rigidifying operator.

We may postulate a set of *ratification-values* $\mathcal{R} = \{\heartsuit, \dots\}$. Armed with these, the three-place \models -relation can be used to constrain a *two-dimensional intension* function for each sentence, with pairs of points of ratification as domain and ratification-values as range, subject to this constraint: $\|\sigma\|_{r'}^r = \heartsuit$ just if $r' \models^r \sigma$. The *diagonal intension* of σ (Δ_σ) is the function $\lambda r \|\sigma\|_{r'}^r$. The definitions of validity and entailment can be rewritten: $\vdash \sigma$ just if for all r , $\Delta_\sigma(r) = \heartsuit$; $\tau_1, \dots, \tau_n \vdash \sigma$ just if for all r , i , if $\Delta_{\tau_i}(r) = \heartsuit$, $\Delta_\sigma(r) = \heartsuit$.

Suppose that our language contains a negation operator \neg ; suppose $\neg\sigma$ is a sentence. In that case, let \mathcal{R} contain $\clubsuit < \heartsuit$, and further constrain the two-dimensional intension function such that $\|\sigma\|_{r'}^r = \heartsuit$ just if $\|\neg\sigma\|_{r'}^r = \clubsuit$.

4.1.2 Ratification as truth

What then is it for r to ratify a semantic value? I will continue to assume that declarative sentences have propositional semantic values, and that the semantic values of the Boolean connectives are the familiar set-algebraic operations.

According to the Classical conception of ratification, r is (or determines) a possible world w_r ; for r' to ratify the proposition p is for p to be true at $w_{r'}$ —namely, $\|\varphi\|_{r'}^r = \heartsuit$ just if $w_{r'} \in p$ (equivalently, $\{w_{r'}\} \subseteq p$). The set-membership relation is *self-dual*: $x \in S$ just if $x \notin \bar{S}$. So because $\llbracket \neg\varphi \rrbracket^r = \overline{\llbracket \varphi \rrbracket^r}$, $w_{r'} \in \llbracket \varphi \rrbracket^r$ just if $w_{r'} \notin \llbracket \neg\varphi \rrbracket^r$. So for any r, r', φ , either $w_{r'} \in \llbracket \varphi \rrbracket^r$ or $w_{r'} \in \llbracket \neg\varphi \rrbracket^r$. But then for any r, r', φ , either $\|\varphi\|_{r'}^r = \heartsuit$ or $\|\varphi\|_{r'}^r = \clubsuit$. So, for declarative sentences, there are exactly two ratification-values: ratification is *bivalent*, and therefore aptly identified with *truth*.

A manifestation of this is that conjunction and disjunction become, like negation, ratification-functional: $\|\varphi \wedge \psi\|_{r'}^r = \min\{\|\varphi\|_{r'}^r, \|\psi\|_{r'}^r\}$, while $\|\varphi \vee \psi\|_{r'}^r = \max\{\|\varphi\|_{r'}^r, \|\psi\|_{r'}^r\}$.

Because propositions are sets of worlds, while the ratification-profile of a proposition maps exactly the worlds in it to \heartsuit and the rest to \clubsuit , a proposition may be identified with any one-dimensional intension it determines. Propositions and one-dimensional intensions are redundant. In particular, it will generally make sense to speak of the ‘diagonal proposition’ of a sentence φ , and for that matter to say that $\vdash \varphi$ just if φ has a necessary diagonal proposition, while $\psi_1, \dots, \psi_n \vdash \varphi$ just if the intersection of the diagonal propositions of the ψ_i is a subset of the diagonal proposition of φ .

Finally, as a consequence of these latter two points, all classical introduction- and elimination-rules for the classical connectives are valid.⁸⁴

4.1.3 Ratification as support

According to a more recent *Informational* conception of ratification,⁸⁵ r is (or determines) an information state i_r ; for r' to ratify the proposition p is for p to be at least as weak as the increment of information represented by i_r —namely, $\|\varphi\|_{r'}^r = \heartsuit$ just if $i_{r'} \subseteq p$. The subset relation is *non-self-dual*: sometimes $T \not\subseteq S$ and $T \not\subseteq \overline{S}$, so *overlap* is dual to subset without being the same relation. So because $\|\neg\varphi\|^r = \overline{\|\varphi\|^r}$, sometimes $i_{r'} \not\subseteq \|\varphi\|^r$ and also $i_{r'} \not\subseteq \|\neg\varphi\|^r$. So for some r, r', φ , neither $i_{r'} \subseteq \|\varphi\|^r$ nor $i_{r'} \subseteq \|\neg\varphi\|^r$. But then for some r, r', φ , neither $\|\varphi\|_{r'}^r = \heartsuit$ nor $\|\varphi\|_{r'}^r = \clubsuit$. So, for declarative sentences, a third ratification-value, \star , can be sensibly introduced: ratification is *trivalent*, and therefore not aptly identified with *truth*, but instead with *belief*—the nontrivial dual of which is *taking seriously*.

A manifestation of this trivalence is that while negation remains ratification-functional (with $\|\neg\varphi\|_{r'}^r = \star$ just if $\|\varphi\|_{r'}^r = \star$), conjunction and disjunction do not: when $\|\varphi\|_{r'}^r = \star$ and $\|\psi\|_{r'}^r = \star$, $\|\varphi \wedge \psi\|_{r'}^r$ can be either \star or \clubsuit , while $\|\varphi \vee \psi\|_{r'}^r$ can be either \heartsuit or \star .

Because propositions are sets of worlds, an intension f will only be straightforwardly identified with a proposition p if $f(r) = \heartsuit$ just if $i_r \subseteq p$, $f(r) = \clubsuit$ just

⁸⁴ \wedge -introduction/elimination: $\|\psi_1\|^c \cap \|\psi_2\|^r = \|\psi_1 \wedge \psi_2\|^r$, so $w_r \in \|\psi_1\|^r \cap \|\psi_2\|^r$ just if $w_r \in \|\psi_1 \wedge \psi_2\|^r$. \vee -introduction, \neg -elimination: trivially.

\neg -introduction (if $R, \psi \vdash \varphi, \neg\varphi$, then $R \vdash \neg\psi$): whenever $R, \psi \vdash \varphi, \neg\varphi$, then for all $c, \bigcap_{\rho \in R} \|\rho\|^r \cap \|\psi\|^r = \emptyset$. Two cases: either $\bigcap_{\rho \in R} \|\rho\|^r$ is always vacuous or not. If so, for no c is w_r a member, so ‘every’ such context is vacuously $\neg\psi$ -verifying. If not, pick such a c for which $w_r \in \bigcap_{\rho \in R} \|\rho\|^r$; but then because intersecting with $\|\psi\|^r$ results in vacuity, $\bigcap_{\rho \in R} \|\rho\|^r \subseteq \overline{\|\psi\|^r}$; and so $w_r \in \overline{\|\psi\|^r} = \|\neg\psi\|^r$.

\vee -elimination (if $R, \psi_1 \vdash \varphi$ and $R, \psi_2 \vdash \varphi$, then $R, \psi_1 \vee \psi_2 \vdash \varphi$): suppose that for all c , if $w_r \in \bigcap_{\rho \in R} \|\rho\|^r \cap \|\psi_1\|^r$, $w_r \in \|\varphi\|^r$; and suppose that for all c , if $w_r \in \bigcap_{\rho \in R} \|\rho\|^r \cap \|\psi_2\|^r$, $w_r \in \|\varphi\|^r$. In that case, for all c , if $w_r \in (\bigcap_{\rho \in R} \|\rho\|^r \cap \|\psi_1\|^r) \cup (\bigcap_{\rho \in R} \|\rho\|^r \cap \|\psi_2\|^r)$, $w_r \in \|\varphi\|^r$. But that union set is the same as $(\bigcap_{\rho \in R} \|\rho\|^r) \cap (\|\psi_1\|^r \cup \|\psi_2\|^r) = (\bigcap_{\rho \in R} \|\rho\|^r) \cap \|\psi_1 \vee \psi_2\|^r$; and we are done.

⁸⁵ Yalcin, ‘Epistemic modals’, 1004. The ascription sands off a disagreement: according to Yalcin, φ is ‘accepted’ in an information state s just if for all $w \in s$, $w \in \|\varphi\|^{c,s}$. By de-indexing the c -parameter from the ratifying s -parameter, Yalcin’s conception of entailment as acceptance-preservation interpreted at any context seems to rule ‘I am here now’ and the like invalid.

if $i_r \subseteq \bar{p}$, and otherwise $f(r) = \star$. But that is a distinctive, special kind of intension. Propositions and intensions are not generally redundant. As a consequence, it will not generally be possible to reduce entailment to relations between diagonal propositions. And for that reason, it should not be expected that the classical introduction and entailment rules will generally be valid—indeed, in short order, we will see reason to think otherwise.

If ratification is support, ratification of declarative sentences is modeled after static pragmatics. In line with the Classical theory of assertion, a context c already has all the information encoded in an assertion of φ (and makes that assertion redundant) just in case $i_c \subseteq \llbracket \varphi \rrbracket^c$. So too, a context c already involves the common acceptance of a procedure encoded in a command with α (and makes that command redundant) just in case $m_c \ni \llbracket \alpha \rrbracket^c$. But if we are willing to regard the condition for declarative sentences as a kind of ratification, I cannot see how to avoid extending the same courtesy to the condition for imperative sentences. So if points of ratification are contexts, both propositions and procedures are among the ratifiables—in line with (P1).

4.2 Modals as intensional operators

We may now introduce dual pairs of *modals* and *rigidifiers* by imposing further constraints on the two-dimensional intension function (I neglect until the end of the subsection the observation that the syntactic operand of a modal is always a nonfinite clause):

21. Intensional operators

(a) Modals:

Where $R(r)$ is a set of points of ratification fixed by r such that $r \in R(r)$,

- i. $\llbracket \Box \sigma \rrbracket_r^c = \heartsuit :=$ for all $r^* \in R(r)$, $\llbracket \sigma \rrbracket_{r^*}^c = \heartsuit$; otherwise,
 $\llbracket \Box \sigma \rrbracket_r^c = \clubsuit$
- ii. $\llbracket \Diamond \sigma \rrbracket_r^c = \clubsuit :=$ for all $r^* \in R(r)$, $\llbracket \sigma \rrbracket_{r^*}^c = \clubsuit$; otherwise,
 $\llbracket \Diamond \sigma \rrbracket_r^c = \heartsuit$

(b) Locally-restricted modals

- i. $\|\Box\sigma\|_r^r = \heartsuit :=$ for all $r^* \in \{r'\}$, $\|\sigma\|_{r^*}^r = \heartsuit$; otherwise,
 $\|\Box\sigma\|_r^r = \clubsuit$
- ii. $\|\Diamond\sigma\|_r^r = \clubsuit :=$ for all $r^* \in \{r'\}$, $\|\sigma\|_{r^*}^r = \clubsuit$; otherwise,
 $\|\Diamond\sigma\|_r^r = \heartsuit$

(c) Rigidifiers

- i. $\|\nabla\sigma\|_r^r = \heartsuit := \|\sigma\|_r^r = \heartsuit$; otherwise,
 $\|\nabla\sigma\|_r^r = \clubsuit$
- ii. $\|\Delta\sigma\|_r^r = \clubsuit := \|\sigma\|_r^r = \clubsuit$; otherwise,
 $\|\Delta\sigma\|_r^r = \heartsuit$

I hope it is evident that the rigidifiers and locally-restricted modals are equivalent, and that the locally-restricted modals are just maximally weak modals. Consequently, whatever is valid for the modals is valid for the locally-restricted modals and therefore the rigidifiers, but not conversely. The symbol ∇ is pronounced ‘dart’ and is a ‘necessity rigidifier’; Δ is pronounced ‘trad’ and is its dual ‘possibility rigidifier’.

The following patterns of entailment fall out:

22. (a) $\Box\sigma \dashv\vdash \neg\Diamond\neg\sigma$ (Duality)
 $\Box\sigma \dashv\vdash \neg\Diamond\neg\sigma$
 $\nabla\sigma \dashv\vdash \neg\Delta\neg\sigma$
- (b) $\Box\sigma \vdash \sigma \vdash \Diamond\sigma$ (T)
 $\Box\sigma \vdash \sigma \vdash \Diamond\sigma$
 $\nabla\sigma \vdash \sigma \vdash \Delta\sigma$
- (c) $\Box\sigma \dashv\vdash \sigma$
 $\nabla\sigma \dashv\vdash \sigma$ (Actuality)
- (d) $\neg\sigma \vdash \neg\Diamond\sigma$
 $\neg\sigma \vdash \neg\Delta\sigma$ (Łukasiewicz’s Principle)⁸⁶

⁸⁶Yalcin, ‘Epistemic modals’, 1005.

The duality of the modals follows from the relationship among \heartsuit , \clubsuit , and negation; (T) follows because modals quantify over points of ratification. Actuality (more on the name later) follows because the distribution of \heartsuit in the diagonal intension of $\heartsuit\sigma$ is identical to that of σ ; Łukasiewicz's Principle is its dual.

How to assign semantic values to the intensional operators in such a way as to generate the intensions in (21)? Note that in all these stipulations, the r' -parameter does not occur free on the right hand side: accordingly, when such an operator takes widest scope in a sentence, the sentence has a constant horizontal intension at any point of interpretation. That requires the semantic value of the sentence relative to any point of interpretation to be extremal: either the trivial proposition W or the vacuous proposition \emptyset , as follows:

23. Semantics for intensional operators

When O is an intensional operator, $\llbracket O\sigma \rrbracket^r = \llbracket O \rrbracket^r(\lambda r' \llbracket \sigma \rrbracket^{r'})$

(a) Modals:

- i. $\llbracket \square \rrbracket^r = \lambda F \{w : (\forall r^* \in R(r))(r^* \models F(r))\}$
- ii. $\llbracket \diamond \rrbracket^r = \lambda F \{w : (\forall r^* \in R(r))(r^* \models \overline{F(r)})\}$

(b) Locally-restricted modals:

- i. $\llbracket \square \rrbracket^r = \lambda F \{w : (\forall r^* \in \{r\})(r^* \models F(r))\}$
- ii. $\llbracket \diamond \rrbracket^r = \lambda F \{w : (\forall r^* \in \{r\})(r^* \models \overline{F(r)})\}$

(c) Rigidifiers:

- i. $\llbracket \heartsuit \rrbracket^r = \lambda F \{w : r \models F(r)\}$
- ii. $\llbracket \Delta \rrbracket^r = \lambda F \{w : r \models \overline{F(r)}\}$

Examples:

- 24. (a) $\llbracket \square\varphi \rrbracket^r = \{w : (\forall r^* \in R(r))(r^* \models \llbracket \varphi \rrbracket^{r'})\}$
- (b) $\llbracket \diamond\varphi \rrbracket^r = \{w : (\forall r^* \in \{r\})(r^* \models \llbracket \varphi \rrbracket^{r'})\} = \{w : r \models \llbracket \varphi \rrbracket^r\}$
- (c) $\llbracket \Delta\varphi \rrbracket^r = \{w : r \models \llbracket \varphi \rrbracket^r\} = \llbracket \diamond\varphi \rrbracket^r$

On the Classical conception of ratification, $r \models p$ just if $w_r \in p$. Slotting this conception into the examples in (24) yields the following:

25. (a) $\llbracket \Box \varphi \rrbracket^r = \{w : (\forall r^* \in R(r))(w_{r^*} \in \llbracket \varphi \rrbracket^r)\}$
 (b) $\llbracket \Diamond \varphi \rrbracket^r = \overline{\{w : (\forall r^* \in \{r\})(w_{r^*} \in \llbracket \varphi \rrbracket^r)\}}$
 $= \overline{\{w : w_r \in \llbracket \varphi \rrbracket^r\}}$
 (c) $\llbracket \Delta \varphi \rrbracket^r = \{w : w_r \in \overline{\llbracket \varphi \rrbracket^r}\} = \llbracket \Diamond \varphi \rrbracket^r$

The first of these should look familiar: (25a) is just the familiar Classical conception of necessity as truth in all members of some contextually selected set of worlds. As for (25b) and (25c), note that by the self-duality of set-membership, $\overline{\{w : w_r \in \llbracket \varphi \rrbracket^r\}} = \{w : w_r \notin \llbracket \varphi \rrbracket^r\} = \{w : w_r \in \overline{\llbracket \varphi \rrbracket^r}\}$, which is easily discerned to be the value of $\llbracket \nabla \varphi \rrbracket^r = \llbracket \Box \varphi \rrbracket^r$. Classically, the rigidifiers and locally-restricted modals are self-dual; moreover, $\{w : w_r \in \llbracket \varphi \rrbracket^r\}$ should be immediately recognizable as the semantic valuation clause for the Classical *actuality* operator—for the value of $\llbracket A\varphi \rrbracket^r$. Thus the name *Actuality* I have given the schema $\sigma \vdash \nabla \sigma$.

(Objection: according to Kratzer and Lewis,⁸⁷ a modalized sentence is typically *contingent*—modeling this requires an accessibility relation, and I have left it out.

Reply: the modal profile of one of Kratzer’s sentences is dependent on how things are in a replica of our conversation—true in worlds where the replica of our conversation involves a certain ‘modal base’ and ‘ordering source’, false in the rest. The informational content of one of Kratzer’s modalized sentences is therefore metaconversational information. While I do agree that the point of modals is to shove around conversational parameters, I do not agree that they get shoved around by our informing one another that they have been so shoved. I am with Stalnaker in thinking of conversations involving metaconversational disagreement or ignorance as defective, and to be modeled by various ‘second-best’ explanatory strategies (such as diagonalization) rather than built into the first tier of explanation.

As for Lewis, dare I say he seems confused? The following seems to conflate contextual restriction of modals with the contextual establishment of an accessibility relation: ‘the restricting of modalities by accessibility or counterpart relations, like the restricting of quantifiers generally, is a very fluid sort of affair: \Box subject to instant change in response to contextual pressures’.⁸⁸ But we

⁸⁷Kratzer, ‘Notional’; Lewis, *Plurality*.

⁸⁸Lewis, *Plurality*, 8.

need not restrict ‘by accessibility relations’ at all, but merely by intrinsic qualities of worlds; nor need ‘accessibility relations’ be subject to ‘contextual pressures’. The added impact of accessibility relations is to give modalized sentences nonextremal semantic values—a point concerning the *semantics* of modals rather than their *pragmatics*. Perhaps cases of ‘nomological necessity’ and the like involve accessibility relations—but the ‘realism’ of such discourse is quite different from the phenomena of this article.)

On the Informational conception of ratification, $r \models p$ just if $i_r \subseteq p$. Slotting this conception into the examples in (24) yields the following:

$$\begin{aligned}
 26. \quad (a) \quad \llbracket \Box \varphi \rrbracket^r &= \{w : (\forall r^* \in R(r))(i_{r^*} \subseteq \llbracket \varphi \rrbracket^r)\} \\
 (b) \quad \llbracket \Diamond \varphi \rrbracket^r &= \overline{\{w : (\forall r^* \in \{r\})(i_{r^*} \subseteq \llbracket \varphi \rrbracket^r)\}} \\
 &= \{w : i_r \subseteq \overline{\llbracket \varphi \rrbracket^r}\} \\
 (c) \quad \llbracket \Delta \varphi \rrbracket^r &= \{w : i_r \subseteq \overline{\llbracket \varphi \rrbracket^r}\} = \llbracket \Diamond \varphi \rrbracket^r
 \end{aligned}$$

Note that ‘less restricted’ modals can be defined within the Informational approach, as in (26a)

The clause for locally-restricted possibility modal in (26b) is equivalent⁸⁹ to Yalcin’s ‘information-sensitive’ semantics for ‘might’: $w \in \llbracket \Diamond \varphi \rrbracket^{c,s}$ just if $\exists w' \in s : w' \in \llbracket \varphi \rrbracket^{c,s}$. Observe that in contrast with the Classical rigidifiers and locally-restricted modals, the Informational operators are non-self-dual: by the non-self-duality of subset, $D := \overline{\{w : i_r \subseteq \overline{\llbracket \varphi \rrbracket^r}\}} \supseteq B := \overline{\{w : i_r \not\subseteq \llbracket \varphi \rrbracket^r\}} = \{w : i_r \subseteq \llbracket \varphi \rrbracket^r\} = \llbracket \nabla \varphi \rrbracket^r = \llbracket \Box \varphi \rrbracket^r$. When i_r strictly overlaps $\llbracket \varphi \rrbracket^r$, $B = \emptyset$ but $D = W$. I return to this in the next subsection.

Whether ratification is truth or support, modals can therefore be understood to quantify over points of ratification and operate on ratifiables—in line with (P2).

4.3 Against truth

How to decide? If ratification is truth, the rigidifiers and locally-restricted modals are self-dual: $\llbracket \Box \rrbracket^r = \llbracket \Diamond \rrbracket^r = \llbracket \nabla \rrbracket^r = \llbracket \Delta \rrbracket^r$. And in that case, (22c) and (22d) are joined by these principles:

⁸⁹Modulo the observation in note 85.

- (22) (e) $\neg \Box \sigma \vdash \neg \sigma$
 $\neg \nabla \sigma \vdash \neg \sigma$ (Actuality-Contrapose)
- (f) $\sigma \vdash \Diamond \sigma$ (LP-Contrapose)
 $\sigma \vdash \Delta \sigma$

Not so, however, if ratification is support.⁹⁰ Consider (22f). Let φ be an ordinary sentence, with a nonextremal semantic value. In that case, $\|\varphi\|_r^r$ is sometimes \heartsuit , sometimes \clubsuit , sometimes \star : φ is *indecisive*. And because \Diamond is an intensional operator, $\|\Diamond\varphi\|_r^r$ is always either \heartsuit or \clubsuit , never \star — $\Diamond\varphi$ is *decisive* (accordingly, there is no ‘diagonal proposition’ for $\Diamond\varphi$).

Because φ is indecisive, so is $\neg\varphi$; and because $\Diamond\varphi$ is decisive, so is $\neg\Diamond\varphi$: \neg is ratification-functional.

But by (22d) and (T), $\|\neg\varphi\|_r^r = \heartsuit$ just if $\|\neg\Diamond\varphi\|_r^r = \heartsuit$. But that means $\Diamond\varphi$ is *weaker* than φ : so (22f) is false. So the Classically valid rule of contraposition fails.⁹¹

And, as Yalcin⁹² observes, for epistemic uses of ‘might’, (22d) seems true and (22f) false: ‘they have not arrived’ apparently commits one to ‘it is not the case that they might have arrived’; but ‘they might have arrived’ does not commit one to ‘they have arrived’.

So ratification is not truth, and points of ratification are not worlds. So either (a) modals do not quantify over worlds or (b) modals do not quantify over points of ratification—in accord with (P3).

Yalcin, as noted, endorses (b). But this conflicts with (P2), and is generally less conservative than an approach on which modals are lashed semantically to indispensable components of the logic rather than to instrumental postulates. The latter course appears risky: if propositions are ‘gunky’ in the way suggested by Stalnaker,⁹³ the semantics will not even be able to hand over individual worlds to

⁹⁰Compare Yalcin, ‘Epistemic modals’, 1006 in regard to the following argument.

⁹¹The situation for dilemma is somewhat different: here the issue is that disjunction (like conjunction, but of course dually) is not acceptance-functional. For nonepistemic φ and ψ , uncertainty regarding φ and regarding ψ is compatible with both uncertainty regarding their disjunction *and acceptance* of the disjunction—again, because of indecisiveness. But together with the decisiveness of $\Box\varphi$ and $\Box\psi$, that means $\varphi \vee \psi$ is *weaker* than $\Box\varphi \vee \Box\psi$.

⁹²Yalcin, ‘Epistemic modals’, 1005.

⁹³Stalnaker, *Mere Possibilities*, 25.

the logic; it would be desirable for the theory of modals to be independent of this consideration. And it appears potentially deleteriously metaphysically committal:⁹⁴ if modals quantify over possible worlds, then the extremal semantic value of an epistemic-modalized sentence suggests its content to be ‘metaphysically necessary’; but it is absurd to suppose that my opinion is metaphysically necessary. If worlds are reduced to their heuristic role, however, this extremal semantic value means just that expressions of opinion are not in themselves informative.

4.4 Finishing up

By way of conclusion, I defend the two remaining premisses in my argument.

The first is (C-ii): the obligative reading of ‘must’ involves the action of $\llbracket \square \rrbracket$ on an operand of type π , while the epistemic reading involves an operand of type p . (1) can be read either ‘sincerely’ or ‘insincerely’: the former involves my commitment to the obligation I am reporting, the latter does not. I submit that in the sincere case, ‘must’ is intended as the locally-restricted necessity modal \square . By (T) and (22c), $\square\alpha$ is equivalent to α ; so on the conception of entailment as support-preservation, this equivalence means that anyone endorsing either of $\square\alpha$ or α is committed to endorse the other. By the earlier conception of the static pragmatics of imperatives, to accept ‘Fred open the door’ is to recognize that a social agent in which one participates with Fred calls on Fred to open the door. I maintain that if one recognizes that, one does indeed commit with full sincerity to Fred’s being under an obligation to open the door. The story for the epistemic case runs in parallel and is familiar.

The second is (D-ii)—the proposition-from-era type-lowering involved in interpreting (2). The discussion of this section has acceded in the standard view that a modalized declarative is a modal operating on a declarative sentence—contra my official logical forms. Instead, logical form supplies a nonfinite clause to the modal; proposition-from-era type-lowering then extracts a propositional semantic value appropriate for the modal. How does that work? Modalized sentences appear at least sometimes to be read in the present tense: each of (2) is most nat-

⁹⁴Brought to me, variously, by Cian Dorr at the 2011 International Summer School in Cognitive Sciences and Semantics, by Geoff Lee in a commentary on my ‘Out of this world’ at the 2013 Pacific APA, and by Juhani Yli-Vakkuri [Yli-Vakkuri](#), ‘Comments’.

usually read as expressing endorsement of the matching present-tensed sentence from (5). ‘At least sometimes’ may be a bit weak: I am hard-pressed to come up with a counterexample to the view that a sentence with a non-obligative modal taking widest scope is *always* read in the present tense. If so, the action of [p|r] is easy to describe: $[p|r]E = \{w : t_c \in E(w)\}$. This loses semantic structure—in accord with (D-ii).

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