The Structure of Communicative Acts

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Abstract Utterances of natural language sentences can be used to communicate not just contents, but also forces. This paper examines this topic from a cross-linguistic perspective on sentential mood (declarative, interrogative, imperative). Recent work in this area focuses on conversational dynamics: the three sentence types can be associated with distinctive kinds of conversational effects called *sentential forces*, modeled as three kinds of updates to the discourse context. This paper has two main goals. First, it provides two arguments, on empirical and methodological grounds, for treating sentential force (context update rules) as part of a compositional dynamic semantics, rather than a dynamic pragmatics. Second, it formulates a minimal dynamic semantic analysis that covers the data at the heart of these arguments, incorporating existing analyses of the three major moods, evidentials and conjunction. A further aim of the paper is to sharpen the distinction between sentential force and utterance (illocutionary) force, and discuss its implications.

Keywords Speech Acts · Mood · Evidentials · Force · Content · Dynamic Semantics · Communication · Cross-Linguistic Semantics · Pragmatics

1 Introduction

In both linguistics and philosophy, the meaning of a sentence is usually analyzed in terms of its truth-conditions: the conditions in which it would it say something true about the world. The influence of foundational work on the semantics of formal logics by Frege, Carnap, Tarski and Montague looms large here. As Frege (1918, 1923) already acknowledged, and as Wittgenstein (1953) and Austin (1962) later urged, natural language is used to do much more than state truths about the world. The truth-conditional model seems suited to capture the meaning of declarative sentences, but what about other sentential **moods**?

(1)   a. Cooper ate a donut. (*Declarative*)

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    b. Did Cooper eat a donut? (*Interrogative*)
    c. Cooper, eat a donut! (*Imperative*)

Can the identification of meaning with truth-conditions sustain this observation? Frege (1918, 293-4) famously maintained that there are two fundamentally different kinds of meaning, **force** and **content**, and held that while (1a-c) do differ in content, their more crucial differences concern their force. On Frege's (1918) model, contents can be thought of as a picture presenting a way some world could be, and force specifies an attitude toward a content determining whether that picture represents our world, inquires what our world is like, or directs the addressee to make our world that way. Frege (1923) is quite clear that force falls outside the domain of semantics because it is not compositionally complex and does not bear on a theory of logical consequence. This edict was eventually challenged.

    Speech act theory (Austin 1962; Searle 1969; Searle & Vanderveken 1985) prominently challenged the Fregean view of logic and compositionality, maintaining that force and content are both central to a semantic theory of natural language. Speech act theorists also took a broader view of what force is, allowing it to encompass more than the simple attitudes mentioned by Frege (1918). They regarded force not just as a type of psychological act, but fundamentally as a social act. They, for example, considered the distinctive way a content, say the proposition that I will bring you a donut tomorrow, can be presented in a social exchange as a promise or a prediction. Similarly, they would recognize distinct forces for difference utterances of (1c) where it is used to effect a command or communicate a suggestion. Speech act theory crucially assumes that force, broadly construed, directly correlates with particular morphemes and linguistic structures. This assumption is deeply problematic, and has been heavily criticized (Davidson 1979, Levinson 1983, §5, Wilson & Sperber 1988, Starr 2014). The empirical reality is that speech act force is too radically under-determined by linguistic form for it to be conventionally encoded. Most current work embraces dynamic pragmatics instead.[1]

    Dynamic pragmatics (Stalnaker 1978; Gazdar 1981; Lewis 1979c; Roberts 1996; Portner 2004), the focus of §2, maintains a traditional Fregean semantics where declaratives, imperatives and interrogatives are assigned distinct contents (a static semantic value). On this picture, semantics concerns only content. But, crucially, this semantics is coupled with a formal theory of discourse context, and a pragmatic model of how utterances change that context. Stalnaker (1978), for example, models assertion in terms of how utterances of a declarative sentence like (1a) change a particular aspect of the context, namely the common ground (those propositions which conversationalists are mutually taking for granted for their exchange). On this model, semantics determines that (1a) denotes a particular proposition, but does not determine how an utterance of a sentence with that content changes a discourse context. Context change must be explained by a pragmatic theory which explains how the content encoded by the sentence and other features of the utterance change the context. Building on Hausser (1980) and Roberts (1996), Portner (2004) extends this model to interrogatives and imperatives by specifying their distinctive contents and pragmatic rules for context change.

    Portner's (Portner 2004, 2007) version of dynamic pragmatics explicitly follows Chierchia and McConnell-Ginet's (2000, §4.3) distinction between two kinds of *force*:

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[1] Accounts like Bach & Harnish (1979) and Wilson & Sperber (1995) are naturally allied with dynamic pragmatic approaches in their broadly Gricean commitments. This Gricean commitment is that force is understood in terms of the speaker intending and producing certain effects in the hearer. While Bach & Harnish (1979) attempt to recast speech act theory in purely Gricean terms, Wilson & Sperber (1995) reject the project of constructing a taxonomy of speech acts.

Sentential Force Sentential force consists in the distinctive ways different *sentence types* are used to change the context, e.g. declaratives are used to change the common ground, interrogatives the questions under discussion and imperatives the to do list (Portner 2004).

Utterance Force Utterance force consists in the distinctive ways *utterance types* change the context, e.g. utterances of (1a) that fall into the class of assertions not only add the proposition that Dale ate a donut to the common ground, but also that the speaker believes that proposition, etc.

While utterance force is closer to the sense of force analyzed in speech act theory, sentential force is closer to Fregean force. In dynamic pragmatics, both sentential and utterance force are outside compositional semantics. While the former is constrained by semantics, it is ultimately a pragmatic process. The latter is even more deeply pragmatic in that it is a property of utterance types, not sentence types. We will also rely on this distinction.

Our main critical point in this paper is that sentential force is best analyzed as part of the compositional semantics of sentences. We argue this on both conceptual and empirical grounds. Conceptually, we argue that it is not possible to ground sentential force in general pragmatic reasoning. Empirically, we show that sentential force is computed recursively in complex sentences, in accord with syntactic structure, and can be modified by operators like evidentials. These interpretive effects are the hallmark of compositional semantics, regardless of whether it is possible to formulate a recursive pragmatic analysis that produces them.

Our positive contribution is to use dynamic semantics (Kamp 1981; Heim 1982; Groenendijk *et al.* 1996; Veltman 1996) to offer an improved account of mood and evidentiality. Our compositional semantics for sentence mood and evidentials in §3 will associate it with certain dynamic effects on context, following Murray (2010, 2014) and Starr (2010, forthcoming).[2] Since we also maintain a distinction between sentential force and utterance force, it is crucial to highlight that this semantics does not amount to saying that declarative sentences semantically encode all of the dynamic effects of assertion. Like speech act theory, we maintain that force is not entirely absent from compositional semantics. But, unlike speech act theory, we only take *sentential force* to be semantically encoded.

This discussion naturally raises the question of how to explain utterance force in terms of sentential force and other pragmatic features of an utterance. §4 addresses this question, arguing that the semantic analysis of sentential force provided here is compatible with the leading pragmatic approaches to utterance force. Building on our discussion of sentential versus utterance force in §2, we argue that linguistic material can only influence utterance force by influencing sentential force.

One novel feature of the discussion here is that sentential mood will be examined alongside evidentiality. Many of the world's languages contain overt morphology, *evidentials*, that mark information source. In some of these langauges, evidentiality and sentential mood exhibit parallels that call for a unified analysis. We will explain why some evidentials require a dynamic semantic treatment, like those proposed by Murray (2010) and AnderBois (2014), rather than a dynamic pragmatic analysis. Together, these two points offer additional support for a dynamic semantic analysis of sentential mood and evidentiality.

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[2] See also Bittner (2014, Ch.6) for a similar dynamic semantics of sentential mood and evidentiality.

2 Sentential Force and Dynamic Pragmatics

This section provides two arguments, on empirical and methodological grounds, for treating sentential force (context update rules) as part of a compositional dynamic semantics, rather than a dynamic pragmatics. Section 2.1 will begin by outlining shared assumptions about sentential mood and sentential force, and then presents a dynamic pragmatic analysis of sentential force. Section 2.2 argues that these updates cannot be grounded in purely pragmatic reasoning. Section 2.3 argues that sentential force is compositionally computed in accord with syntactic structure, and therefore merits a semantic analysis. We conclude the section with a discussion of various objections to analyzing sentential force as part of a compositional dynamic semantics (§2.4).

2.1 Sentential Mood, Sentential Force and Dynamic Pragmatics

Our discussion throughout will follow typological work (Sadock & Zwicky 1985; König & Siemund 2007) that posits a universal three-way distinction between **sentence types**: declarative, interrogative and imperative (and 'others' like exclamatives).[3] König & Siemund (2007, 278) identify these types on functional and morphosyntactic (including intonational) grounds by examining over 50 carefully selected languages, and the extensive literature on several of these langauges.

As König & Siemund (2007, 282) stress, many languages morphosyntactically mark further subdivisions within a sentence type. This means that it will be important to distinguish sentence type from sentence mood. English morphosyntax, for example, does not sharply distinguish (2)-(5).

(2) May she sing! (Optative)
(3) Sing! (Pure Imperative)
(4) Let's sing! (Hortative)
(5) Don't sing! (Prohibitive)

However, many languages, like Cheyenne, do distinguish (at least a subset of) them.[4] We will call **sentence mood** the morphosyntactic paradigms (including intonation) used to divide and subdivide sentence types. For English, the distinction between sentence type and sentence mood means little since there are three sentence types and three sentence moods.[5] But for languages like Cheyenne (Murray 2016), Kalaallisut (Bittner 2011), Korean (Pak *et al.* 2004, 2008), and many others this will matter. For example, Cheyenne verbal morphology does not simply mark a three-way distinction between declarative, interrogative and imperative sentence types. Imperative sentences in Cheyenne, employ distinct verbal suffixes for immediate pure imperatives (6a), delayed pure imperatives (6b), and for hortatives (6c) (Leman 2011, 41) — more on Cheyenne mood in §2.3.

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[3] König & Siemund (2007) supersedes Sadock & Zwicky (1985) in the second edition of *Language Typology and Syntactic Description*.

[4] See also van der Auwera *et al.* (2008a); Dobrushina *et al.* (2008); van der Auwera *et al.* (2008b), Aikhenvald (2010) and Pak *et al.* (2004, 2008).

[5] We're setting aside exclamatives, cf. Michaelis (2001) vs. Zanuttini & Portner (2003) vs. Rett (2012). There is also little work on the functional implications of intonation in English imperatives, leaving open the possibility that intonation and other articulations approximate distinct sentence moods for optative, hortative and prohibitive uses.

(6) a. *Némene-**stse**!*
    sing-IMP.2SG
    '(You (sg.)) sing (now)!'
  b. *Némene-**o'o**!*
    sing-DEL.IMP.2SG
    '(You (sg.)) sing (later)!'
  c. *Némene-**ha**!*
    sing-HRT
    'Let him sing!'

Because sentence types are both morphosyntactically and functionally individuated, it makes sense to group together the distinct sentence moods in (6). They share certain morphosyntactic properties that distinguish them from declaratives and interrogatives.[6] They also share a functional property: they have a directive discourse function. For this reason, we will use the term *directive sentence type* to include pure imperatives, hortatives and optatives.[7]

It is very important to clarify that not all linguists identify sentence type on the basis of functional and morphosyntactic paradigms. Zanuttini & Portner (2003), Portner (2004), Pak *et al.* (2004), Pak *et al.* (2008) develop an alternative approach to sentence-typing, arguing that morphosyntactically diverse structures with the same function are problematic for the approach outlined in the previous paragraph. For example, Zanuttini & Portner (2003) emphasize the importance of languages like Greek and Italian which prohibit imperative verbal morphology for negative sentences like *Don't read!*, instead using indicative and infinitive verbal morphology (respectively). Their alternative account bases sentence type exclusively on *semantic type* — in the sense familiar from Montagovian semantics — and is integrated with sophisticated dynamic pragmatic accounts in Portner (2004) who proposes a tripartite model of context $\langle C, Q, T \rangle$:

1. **Common Ground (C)** The propositions mutually assumed for the conversation: set of propositions.
2. **Question Set (Q)** The questions mutually adopted for the conversation: set of sets of propositions.
3. **To-Do List (T)** For each agent x, the properties it is mutually assumed that x is to make true: function from individuals to sets of properties.

On this view, a sentence type counts as declarative because its members denote a proposition, and utterances of sentences denoting propositions count as attempts to add that proposition to the common ground. As Portner (2016, 603) puts it, this account gives a distinctive answer to 'the conventionalization question' — *How does a sentence get associated with a particular sentential force?*: via pragmatic principles that assign a context update to a root clause as a function of its semantic content:[8]

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[6] Such as lacking a person prefix and requiring a distinct forms of plural morphology (Leman 2011, 41–2, Murray 2016, 500–1).

[7] We note that Lyons (1977, 748) proposes the term *jussive* for what we are calling directive sentences, and authors like Zanuttini *et al.* (2012) follow Lyons (1977, 748). This can also be confusing since this term is used for a specific directive sentential mood that is restricted to the third-person (e.g. Aikhenvald 2010).

[8] More formally:

$$\langle C, Q, T \rangle + \phi = \begin{cases} C \cup \{\llbracket \phi \rrbracket\} & \text{if } \llbracket \phi \rrbracket \subseteq W \ \& \ \phi \in Root \\ Q \cup \{\llbracket \phi \rrbracket\} & \text{if } \llbracket \phi \rrbracket \subseteq \mathscr{P}(W) \ \& \ \phi \in Root \\ T(a) \cup \{\llbracket \phi \rrbracket\} & \text{if } \llbracket \phi \rrbracket \subseteq D \times \{0,1\} \ \& \ \phi \in Root \end{cases}$$

Dynamic Pragmatic Principles (adaptation of Portner 2016, 612)
1. *Declarative Effect*: The utterance of a root clause ϕ counts as an attempt to add its content to the Common Ground if $[\![\phi]\!]$ is a proposition
2. *Interrogative Effect*: The utterance of a root clause ϕ counts as an attempt to add its content to the Question Set if $[\![\phi]\!]$ is a set of propositions
3. *Imperative Effect*: The utterance of a root clause ϕ counts as an attempt to add its content to the To-do List if $[\![\phi]\!]$ is a property of individuals

Our main critical points in this paper will concern this dynamic pragmatic analysis of sentential force, and we will not attempt to directly engage with the question of whether sentence types should be determined by semantic type. As even Portner (2016, 605) acknowledges, data like that from Greek and Italian do not rule out a truly morphosyntactic approach that uses syntactic configurations, morphology and functional properties to determine sentence type. Such an account may also need to include intonation to avoid positing polysemous configurations, but that is not unprecedented.[9] Focusing on a language like Cheyenne, where the mapping between sentence mood and sentential force is (more) direct allows us to focus instead on the analysis of sentential force.

While sentential force is central to the way Portner (2004) approaches sentence types, the other principle works of dynamic pragmatics — Stalnaker (1978, 2014) and Roberts (2018) — do not use this terminology at all. So it will be important to clarify both the general explanatory importance of sentential force and how it fits into the accounts developed by Stalnaker (1978, 2014) and Roberts (2018). We will begin with the expository task, as it will emerge from this how sentential force features in these accounts.

Stalnaker (1978, 87) is clear that the semantic content of a declarative sentence (relative to context) is a proposition, and that a necessary condition of assertions (a particular utterance force) is that their propositional content is added to the common ground. Stalnaker (2014, §2.5) provides a more detailed model of this view where there are two different kinds of conventions (or 'rules') involved in speech acts, thought of as moves in a language game:

> The moves in the game will involve a language that has a semantics (a grammar, in Lewis's terminology) that matches sentences with propositions as a function of the context. A move in the game will be the production of a sentence with a certain conventionally indicated force, where force is explained in terms of the way that the move is intended to change the context. So the game will be defined by rules of two kinds: lexical and compositional rules that determine the *content* of what is said, and rules that determine the *force* with which the content is said. Assume that the speech act of *assertion* is governed by the following rule: an assertion changes the context by adding the propositional content of the assertion to the common ground. (Stalnaker 2014, 50–1)

This fits to some degree with the Portner (2004) analysis, as it agrees that there are two distinct sets of rules, compositional semantics and discourse rules, and that the latter operate on the semantic content provided by the former. However, it does not quite fit as Stalnaker

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This differs from Portner (2004, 238), which does not have the root clause restriction. This incorrectly allows non-sentential clauses to update the context. Portner (2007, 373) provides a third way of filling out the *if*-clauses: *if* $\phi \in Dec$, *if* $\phi \in Int$, *if* $\phi \in Imp$. While this is equivalent if one assumes the Zanuttini-Portner semantic type approach to clause-typing, it is not generally equivalent. Given all this, we take the Portner (2016, 612) formulation to be the authoritative statement of the view.

[9] See Aikhenvald (2010, §3.1) and Bittner (2014) for work that pursues this idea. See also our discussion of rising declaratives in §3.4.

is talking here about utterance force (assertion), rather than sentential force. But Stalnaker (2014, 89) later clarifies that assertion involves much more than common ground update:

> I should emphasize that I am not claiming that one can *define* assertion in terms of a context-change rule, since that rule will govern speech acts that fall under a more generic concept. A full characterization of what an assertion is would also involve norms and commitments. And whether [a declarative] speech act counts as an assertion or not will be partly a matter of what kind of discourse it is — what its common purposes are taken to be. A more general kind of speech, still governed by the same context-change rule, will include conjectures and other less committal conversational moves. Just as what is mutually accepted for purposes of the conversation may in some cases involve a mutually recognized pretense, so in the right kind of context, the speech act itself made may be a proposal to accept something only in a sense of acceptance that diverges from belief.

This elaboration of the view clarifies matters considerably, as it highlights the fact that the Declarative Effect is common to a whole genus of speech acts (utterance forces). By formulating one discourse rule that applies to all propositional utterances, one can capture the fact that all of these speech acts involving declarative sentences all have a common effect on the context and thereby predict rather than stipulate certain data. For example, an assertion, a conjecture or theatrical performance of (7a) provides the background information to interpret an utterance of (7b) — which may itself have any of these utterance forces.

(7)   a. Dale has a donut.
      b. Harry has a donut too.

This makes clear both why sentential force is an empirically important concept, and how it features even in accounts like Stalnaker (2014) that do not directly mention it. It is, of course, unclear how exactly it fits into a detailed model of speech acts for Stalnaker (2014), since he does not explicitly formulate the other 'norms and commitments' he mentions for creating utterance forces like assertion. Are these discourse rules akin to those of speech act theory, or can they be reduced to purely Gricean reasoning and features of the discourse context? Stalnaker (2014) is not clear on this issue, and Portner (2004, 238) only briefly mentions how *some* utterance forces like permitting and ordering might be generated from contextual assumptions. Roberts (2018), however, is plausibly interpreted as showing how to derive utterance force from contextual assumptions, sentence force and Gricean reasoning.

While Roberts (2018) also does not explicitly mention sentence force, Roberts (2018, §2) outlines rules for declarative, interrogative and imperative mood that parallel the Dynamic Pragmatic Principles in all relevant respects. In particular, Roberts (2018, §2) provides pragmatic rules specifying how declarative, interrogative and imperative utterances respectively update context.[10] Further, it is quite clear that Roberts (2018) takes an utterance force of, say a request, to consist in much more than an update to the context. Roberts (2018, §4.1) sketches how, from the default interrogative context update of *Will you please get a check up?*, one can recover, using contextual assumptions and Gricean reasoning, the fact that a request has been made — roughly assuming the characterization of requests from Searle (1979, Ch.1). This Gricean reasoning is not itself particularly novel to Roberts (2018) as it closely parallels other Gricean accounts of speech acts such as Bach & Harnish (1979), Cohen & Perrault (1979), Cohen & Levesque (1985) and Cohen & Levesque (1990). What's

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[10] It is worth noting that the rules of Roberts (2018, §2) assume that these clause types are distinguished on morphosyntactic grounds rather than semantic type as on the Zanuttini-Portner model. But Roberts (2018, §4.2) later reformulates these rules within the Zanuttini-Portner framework.

important for our purposes here is to note that all of these broadly Gricean analyses make use of an assumption about how the three major sentence types constrain speech act recognition. In dynamic pragmatics, this assumption takes the form of the Dynamic Pragmatic Principles, while in traditional Gricean approaches it involves saying what mental state is expressed by each of the three sentence types. However, in both cases, something akin to sentential force is an essential premise in the Gricean reasoning that recovers the force of an utterance.

While work in dynamic pragmatics has not explicitly discussed the explanatory role of sentential force, the exposition above has highlighted two:

Explanatory Roles of Sentential Force
1. Sentential force explains common contextual effects found across different speech acts performed with the same sentence type.
2. Sentential force provides an essential input to pragmatic processes which determine the force of an utterance (i.e. speech act type).

We take this to be important common ground between the account we will offer below and dynamic pragmatics. However, our crucial difference is that we think sentential force is better captured as part of a compositional dynamic semantics. We provide two arguments:

Why Sentential Force is Semantic
1. The Dynamic Pragmatic Principles cannot be adequately grounded in pragmatic reasoning (§2.2).
2. Sentential force exhibits compositional complexity: sentential connectives can combine sentential forces and operators like evidentials can modify it. (§2.3)

The first argument, detailed in §2.2, shows that even dynamic pragmatics must assume that root clauses, in virtue of their linguistic nature, have a special significance for updating the context that cannot be reduced to purely pragmatic reasoning. The second argument, detailed in §2.3, shows that in complex sentences, sentential force must be recursively calculated in accord with linguistic structure. These two arguments establish that treating sentential force as semantic fits better with the shared overall assumption that compositional semantics captures the recursive features of meaning that are specifically grounded in linguistic structures.

2.2 Argument 1: status of the dynamic pragmatic principles

To count as genuinely pragmatic, the Dynamic Pragmatic Principles must follow from general pragmatic considerations. This is not to say that on each occasion of utterance they are pragmatically calculated. These principles may count as 'conventions of use' (Morgan 1978), or 'illocutionary standardizations' (Bach & Harnish 1979, Ch.9), which arise when pragmatic inferences become routinely associated with a grammatical form.[11] However, there has been virtually no attempt to spell out this pragmatic reasoning in dynamic pragmatics, and among the Neo-Gricean approaches to speech acts that specialize in spelling out that kind of reasoning it is assumed that something parallel to the Dynamic Pragmatic Principles is semantic.[12] The closest one gets is a very brief sketch in Portner (2004, 240):

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[11] Roberts (2018, §4.2) proposes the conventions of use interpretation, crediting personal communication with Mandy Simons. The 'conventions of use' proposed by Morgan (1978) exactly parallel the 'illocutionary standardizations' of Bach & Harnish (1979, Ch.9).

[12] Both Bach & Harnish (1979, §2.5) and Cohen & Levesque (1990) take sentence types to constrain pragmatic inferences which establish utterance force, by constraining the types of attitudes those sentences can express. However, they take this constraint to be *semantic*.

"Since an imperative denotes a property, it is not suitable for being added... to the Common Ground or Question Set. It is suitable for being added to a To-Do List." This idea is echoed by Roberts (2018, §4.2): "The correlation noted in the [Dynamic Pragmatic Principles] is natural. The semantic types of the root sentences lend themselves naturally to the tasks they canonically serve." But this sketch does not stand up to close examination.

The first problem is that if this kind of reasoning sufficed to establish sentential force, it would badly overgenerate. It would entail not just that root clauses denoting, say propositions, are suitable for being added to the Common Ground, it would entail that any clause with that semantic type does. And yet, uttering *that Cooper is hungry* or *the information that Cooper is hungry* is not a possible way to update the Common Ground with the proposition that Cooper is hungry.[13] Indeed, Portner (2016) and Roberts (2018) restrict the Dynamic Pragmatic Principles to utterances of root clauses to avoid just this problem. But the challenge is that this restriction is not grounded in the kind of pragmatic reasoning they offer to ground the Dynamic Pragmatic Principles. The second problem is that even if the *restriction* were justified, traditional semantic objects have no 'natural' sentential force.

The kind of reasoning sketched by Portner (2016) and Roberts (2018) suggests that a property or set of worlds can 'lend itself naturally' to directive or representational discourse functions. But this is an idea that has been convincingly rejected by philosophers working on the nature of semantic objects like propositions. It is entirely appropriate to characterize the content of a picture of a boxer in terms of a set of worlds — the ways the picture depicts the world to be. As Wittgenstein (1953, Note to §22) observes, this picture could be used to equally to depict how a boxer once stood *and* how a boxer should stand. The set of worlds used to model the content of the picture is equally silent on how the force of the picture is to be construed. This flexibility is actually widely exploited even within formal semantics, where semantic type is assumed to *not* determine force in any way. Sets of worlds have been used to model directive contents (Huntley 1980; Russell 2007), properties have been used to model representational contents (Lewis 1979a; Egan 2007) and sets of propositions have been used to model representational content (Groenendijk & Roelofsen 2009; Simons 2005, 286). On reflection, it is immensely difficult to articulate exactly how a set of worlds could intrinsically encode a representational function, or any function at all. For this reason, philosophers working on the nature of propositions conclude that there must be something more to the meaning of declarative sentences than a set worlds so as to distinguish them from the picture of a boxer and other sentence types (King *et al.* 2014).[14] While we will not compare our dynamic semantic analysis to these philosophical theories of propositions here, our accounts falls broadly within this family of views.

This discussion brings us full circle to the restriction dynamic pragmatics must stipulate: that only semantic objects denoted by root clauses can trigger context updates. It should now be clear *why* that restriction cannot be grounded in purely pragmatic reasoning: there is something more to the way root clauses function in discourse than their traditional semantic content and pragmatic reasoning can capture, and this 'something more' specifies

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[13] It is not universally accepted that *that*-clauses denote propositions — they may instead denote functions from individuals to propositions as Lewis (1979a) and Moulton (2015) do. But some also argue that declarative clauses denote such functions too (Egan 2007; Stalnaker 2014, Ch.5), on the grounds that indexicals and related phenomena not only communicate information, but an individual's perspective on it. For related phenomena, it has been argued that one must distinguish between the objects of assertion, and a clause's compositional semantic value (Ninan 2010; Yalcin 2011). These philosophers argue that the objects of assertion have to be derived from semantic value. This coheres with a point discussed shortly: particular compositional semantic types are highly negotiable in semantic theory. Being negotiable, and indirectly related to the objects of speech acts makes them a unsound foundation for a theory of sentential force.

[14] See Stainton (1999) for related observations.

how they change the context. This leaves us with a pressing question: if sentential force is not determined by traditional semantic content and general pragmatic reasoning, how is it determined? The quotation from Stalnaker (2014, 113) suggests, albeit *very* elliptically, a view that is rather different from Portner (2016) and Roberts (2018). Perhaps there are *rules of sentence use* that are neither semantic nor properly pragmatic. They are not routinized pragmatic inferences, but are the constitutive rules used to integrate language (a generative grammar with a traditional model-theoretic semantics) into rule-governed social practices. This is very close to the model proposed by Stenius (1967), and echoes some of the key concepts in speech act theory (Searle 1969, 1979; Searle & Vanderveken 1985). But this approach faces two problems. First, it does not fit with the crucial distinction between sentential force and utterance force. An utterance force, say of assertion, might count as a rule-governed social practice, but a sentential force like the Declarative Effect says nothing about social interaction. Second, the argument to follow in §2.3 shows that the conventions governing sentential force have the key features of semantic conventions: they apply recursively in accord with linguistic structure. This is, of course, equally problematic for the 'rules of use' approach and the more thoroughly pragmatic approaches of Portner (2016) and Roberts (2018).

2.3 Argument 2: connectives and evidentials modify sentential force

Whenever interpretive effects are recursive and systematically sensitive to linguistic elements, they are best explained semantically. In this section, we will argue that sentential force has exactly these properties and so is best explained semantically. This argument will concern two empirical phenomena: complex sentences featuring connectives that combine more than one sentence type and evidentials that modify the sentential force of sentences in which they occur. Since sentential force is recursively computed in accord with syntactic structure, and can be modified by linguistic operators like evidentials, a semantic analysis is generally preferable to a pragmatic one.[15]

Imperatives and declaratives combine in a number of ways in conjunctions, and this has generated a substantial literature. But what has not be adequately appreciated in that literature is that they often combine in an entirely standard way (Starr forthcoming):

(8) I love you and don't (you) forget it.

This sentence features the conjunction of a declarative and an imperative, and it combines the two in exactly the same way a purely declarative conjunction works: the sentential force of each clause updates the context of utterance. As stated, the Dynamic Pragmatic Principles, together with an orthodox semantics for conjunction, does not predict this. If you intersect the proposition denoted by the declarative conjunct and the imperative conjunct you simply get the empty set. This incorrectly predicts that (8) adds the contradictory proposition to the common ground. Is it possible to alter dynamic pragmatics in some way to capture this?

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[15] Our argument will assume that syntactic structures are binary-branching only. If this assumption is relaxed, then our argument only shows that sentential force is iteratively computed. Nothing hangs on this, as iterative computation is also distinctive of semantic competence in non-binary grammatical theories. We thank an anonymous reviewer for highlighting this.

A simple proposal is to alter the pragmatic update rules to recursively add these contents to the appropriate part of the context.[16] There are a number of ways to implement this proposal, but the following is the most straightforward:[17]

Recursive Dynamic Pragmatic Principles

1. *Declarative Effect*: The utterance of a root clause ϕ counts as an attempt to add its content to the Common Ground if $[\![\phi]\!]$ is a proposition
2. *Interrogative Effect*: The utterance of a root clause ϕ counts as an attempt to add its content to the Question Set if $[\![\phi]\!]$ is a set of propositions
3. *Imperative Effect*: The utterance of a root clause ϕ counts as an attempt to add its content to the To-do List if $[\![\phi]\!]$ is a property of individuals
4. *Conjunctive Effect*: The utterance of a root clause $\phi \wedge \psi$ counts as an attempt apply rules 1-4 to the utterance of ϕ and the utterance of ψ

But far from saving dynamic pragmatics, this proposal dramatizes its limitations. First, consider the fact that this complex behavior is not at all limited to conjunction:

(9) Donate donuts because cops need to eat too! Donate lots of donuts unless you are unable to afford it. Do it regardless of whether you fear the police.

(10) Offer kindness to all fellow humans but you should be careful not to be taken advantage of. That drifter may be handsome but is he really only taking your car for a short drive? Do something kind today or I'll do something kind today, I don't care which. But someone should do something kind every day.

What emerges is that for each way of combining sentence types with connectives, dynamic pragmatics requires a new rule, and it requires that these rules apply recursively in accord with linguistic structure. Our concern here is not the possibility of writing down such a theory.[18] Our concern is much simpler: any such pragmatic theory is less appealing than a semantic one that predicts this compositional behavior. There is much debate at the interface of semantics and pragmatics, but the one constant in this literature is that recursive interpretive effects that mirror linguistic structure are semantic. If, for some reason, dynamic pragmatics was our only option, perhaps this sacred methodological principle could be called into question. But it is not. A dynamic semantic analysis of sentential mood can capture this easily. It also bears emphasis that, given the argument of §2.2, each of these new connective rules compounds the problem for claiming that this analysis is genuinely pragmatic. It is generally unclear how to ground the rules of sentence force in general pragmatic reasoning, but even harder once one begins to add a long list of rules specific to particular connectives.

Defenders of dynamic pragmatics have sometimes replied, in conversation, to data like (8) by claiming that they don't feature real imperatives or that they feature semantically special 'discourse connectives'. This reply highlights one of the challenges of investigating complex sentence types using only English. Many languages use overt sentence mood

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[16] This process must be recursive, since one of the conjuncts may itself be a conjunction, e.g. *Your father loves you and I love you and don't you forget it*.

[17] We thank an anonymous reviewer for suggesting this formulation on behalf of dynamic pragmatics. This formulation has the consequence of making this occurrence of *and*, and all similar occurrences of other connectives, syncategorematic. For conjunction, this could be avoided by lifting the type of each basic sentence type from t to $\langle t \rangle$, and having conjunctions denote ordered pairs consisting of the tuples denoted by their parts. As detailed in Starr (forthcoming), applying this method to all the necessary connectives at once may not be possible, and at the very least, also requires a recursive set of update rules that mirror syntactic structure.

[18] Starr (forthcoming, §2.1.2) discusses that possibility in detail. While stopping short of an impossibility theorem, he highlights very significant obstacles and shows that if it is possible to capture each connective with a special pragmatic update procedure then the pragmatic theory must update contexts recursively in accord with linguistic structure.

morphology and contain a range of discourse particles that can modify connectives to transparently form 'discourse connectives'. One such language is Cheyenne.[19] Cheyenne also features a grammatical evidential system, where each verb is obligatorily marked for information source — a detail to which we will return shortly. An excerpt of the Cheyenne matrix mood paradigm is given below in (11); there are also other evidentials, an immediate imperative mood, a hortative mood, which is similar to imperative mood, and moods for dependent (embedded) clauses (see Murray 2010, 2016).[20]

(11) Some Cheyenne Matrix Moods (Leman 2011)

    a. <u>Declarative + Direct evidential</u>

       É-néméne-∅.
       3-sing-DIR
       'He sang (I witnessed).'

    b. <u>Declarative + Reportative evidential</u>

       É-némene-sèstse.
       3-sing-RPT.3SG
       'He sang, I hear.'

    c. <u>Interrogative</u>

       *Né-némene-**he**?*
       2-sing-INT
       'Did you (sg.) sing?'

    d. <u>(Delayed) imperative</u>

       *Némene-**o'o**!*
       sing-DEL.IMP.2SG
       '(You (sg.)) sing (later)!'

Because Cheyenne marks mood explicitly on every verb, it is much easier to establish which clauses are genuine imperatives. Consider Cheyenne (12), a conjunction of a declarative and an imperative. Each conjunct is a complete sentence on its own, as shown in (13) and (14).

(12) *Ná-to'se-némene-∅*   *naa* *ho'sóe-**o'o**!*
      1-PROS-sing-DIR   and dance-DEL.IMP.2SG
    'I am going to sing and (you) dance!'

(13) *Ná-to'se-némene-∅.*
      1-PROS-sing-DIR
    'I am going to sing.'

(14) *Ho'sóe-**o'o**!*
      dance-DEL.IMP.2SG
    '(You) dance!'

As discussed in Murray (2017a), Cheyenne has a range of morphemes that combine with *naa* to specify which sense of conjunction is intended. However, in (12) bare *naa* is used, just as it is used to form plural subjects like *Andy and Harry*. Cheyenne makes clear that there is little motivation for simply denying that true conjunctions cannot combine different sentence types. Indeed, the system of evidentials in Cheyenne provide a further argument against a dynamic pragmatic analysis of sentential mood. This argument will require a bit of background on evidentials.

    Many of the world's languages have explicit morphology, evidentials, which encode an agent's source of evidence. Sentences in these languages convey two pieces of information, the **scope proposition** p and the **evidential proposition** q. For example p might be the proposition that it is raining, while q might be the proposition that the speaker's evidence for

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[19] Cheyenne is an Algonquian language spoken in Montana and Oklahoma. The data discussed in this paper are from Author 1's fieldwork in summers since 2006, supplemented with a Cheyenne Grammar (Leman 2011), collections of texts (Leman 1980a, 1987), and a dictionary (Fisher *et al.* 2006). Morphological analysis, glossing, and translation for all included data is Author 1's.

[20] Since matrix mood morphemes and evidentials occur in the same verbal slot in Cheyenne, and all dependent clauses must be marked with dependent mood morphology, evidentials do not occur in dependent clauses (Murray 2016).

p is a report. What is interesting from the present perspective is that these two contents have a very different status in the communicative exchange and in the compositional semantics of the sentence (Faller 2002; Matthewson *et al.* 2007; Murray 2010). Evidentials always scope over negation and the evidential proposition has a backgrounded status: it cannot be directly challenged with phrases like *that's not true*. Further, the evidential contribution can sometimes modify the status of the scope proposition. For example, in the Cheyenne data discussed below, using the reportative evidential frees the speaker from commitment to the scope proposition. Indeed, one can even follow up a reportative claim that *p* by denying *p*.

Even on this cursory description, it should be clear that evidentials do not simply modify the content of the sentence they occur in by creating a new content. Instead, they modify the way that content is being used to update context. In other words, evidentials appear to be semantically modifying sentential force. This would be a significant challenge to the key idea behind dynamic pragmatics since it amounts to saying that sentential force, a pragmatic phenomenon, is semantically modified by a linguistic operator.[21] Again, the challenge here would not be to write down a recursive pragmatics that achieves the same effects as a dynamic semantic one. It is *justifying* the label of 'pragmatic' that sets these recursive, linguistically conditioned rules apart from the compositional semantics. As in the case of sentential mood, we will propose that it is better to just build these dynamic effects of evidentials into the compositional semantics, following Murray (2014, 2017b).

Making this point about evidentials more explicit requires a more careful presentation of the relevant data. In Cheyenne (15), the scope proposition — the proposition the speaker has evidence for — is that Annie danced. In (15), the evidential proposition — the proposition that the speaker has a certain kind of evidence for the scope proposition — is that the speaker has reportative evidence that Annie danced, e.g., they heard a report that Annie danced.

(15) *É-ho'sóe-sèstse   Annie.*
     3-dance-RPT.3SG   Annie
     'Annie danced, I hear.'

Though sentences with evidentials contribute both an evidential proposition and the scope proposition, these propositions do not have the same discourse status. For example, in Cheyenne (16), the proposition that Annie danced — the scope proposition — is directly challengeable, but the proposition that the speaker heard that Annie danced — the evidential proposition — is not directly challengeable.[22]

(16) A: *É-ho'sóe-sèstse   Annie.*   B: ✓ *No she didn't (dance). She sang.*
        3-dance-RPT.3SG   Annie   # *No you didn't (hear that).*
        'Annie danced, I hear.'

Furthermore, when negation is added, it modifies the scope proposition, as in (17). It cannot negate the evidential content.[23]

(17) *É-sáa-ho'sóe-he-sèstse   Annie.*
     3-not-dance-NEG-RPT.3SG   Annie

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[21] Some have attempted to analyze this data by treating evidentials as illocutionary operators in Searle's framework (Faller 2002). As mentioned in §1, that framework does not enable one to distinguish between sentential force and utterance force. While designed for languages that are different from Cheyenne, Matthewson *et al.* (2007) analyzes evidentials as modals. Assimilating all evidentials to modals involves stipulating much of the interesting behavior in languages like Cheyenne rather than explaining it.

[22] The evidential content can be indirectly challenged, e.g., *Who said that?*

[23] This behavior is similar to presuppositions, but the evidential content is discourse-new information.

'Annie didn't dance, I hear.'
✖ 'I didn't hear that Annie danced.' / ✖ 'Annie danced, they didn't say.'

Based on these data and other semantic diagnostics (see, e.g., Potts 2005; Simons *et al.* 2011; Tonhauser 2012), several researchers have concluded that the evidential proposition is typically not-at-issue while the scope proposition is typically at-issue (e.g., Murray 2010, 2014).[24] One way of thinking of the at-issue/not-at-issue distinction is as a distinction in attention: we attend to the at-issue propositions in a way that we do not for the not-at-issue propositions (see Section 3.3 and Bittner (2011) for attention in other domains). On this model, there are different ways to update context with a proposition: (a) add it to those being attended to (at-issue) and (b) add it to those that are being assumed in the background (not-at-issue). While English declaratives do both (a) and (b) with their propositional content, evidentials in Cheyenne declaratives enrich the (b) part of the update.[25] This analysis amounts to saying that there is morphology in Cheyenne that modifies sentential force. Whether or not one can modify dynamic pragmatic rules to capture this behavior, it has the very hallmark of compositional semantics: recursive interpretation that mirrors linguistic structure.

The main point of this section is nicely illustrated by considering the interaction of mood, connectives and evidentials in the Cheyenne example (18). It is a conjunction of declarative sentences, the first with a reportative evidential, the second with a direct evidential. The scope proposition in (18ii) is the negation of the scope proposition in (18i).

(18) (i)   *É-némene-sėstse*   *Annie*   *naa oha* (ii) *é-sáa-némene-he-∅*.
            3-sing-RPT.3SG   Annie   but   3-not-sing-NEG-DIR
            'Annie sang, they say, but (I witnessed that) she didn't.'

Example (18) shows that sentences with the reportative evidential make no commitment to the truth of the scope proposition: in (18), the speaker has direct evidence to the contrary of what was reported (see also Faller 2002; Murray 2014). Crucially, the two scope propositions in (18) are contradictory. But this sentence does not change the common ground in a contradictory way. Intuitively, the truth conditions are that the speaker has reportative evidence that Annie sang, direct evidence that she didn't, and that Annie did not sing. This means that the reportative evidential has to modify the sentential force of the declarative it appears on, and that this effect must occur 'underneath' the connective *naa* since it does not modify the second declarative. So not only does sentential force effectively scope under conjunction, it is modified by an operator in the first conjunct.

It may be possible to further complicate the recursive dynamic pragmatics to model the behavior of evidentials, but there are powerful methodological reasons to pursue a semantic account instead. If sentential force recursively calculated in accord with syntactic structure and modified by operators like evidentials, it is better to treat it as part of a compositional dynamic semantics. As Murray (2010, 2014, 2017b) shows, this simple assumption not only allows one to capture the meaning of evidentiality and sentential mood, it also explains the interesting behavior of appositives and slifting across many languages. A dynamic semantic analysis of these additional phenomena makes it possible to offer a more tidy picture of what

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[24] On this view, evidentials are similar to appositives in that they contribute not-at-issue content (Potts 2005), but they can also affect the level of commitment to the scope proposition, illustrated in (18); see §3.3.

[25] This view of English declaratives semantically models Stalnaker's (Stalnaker 1978) theory of assertion where a declarative utterance (a) proposes a proposition for addition to the common ground, and (b) that proposition becomes part of the common ground if no one objects. Murray (2014) argues that English appositives, among other phenomena, contribute only to the (b) component, much like evidentials. For related work on English declaratives see Farkas & Bruce (2010).

compositional semantics is than accounts built on conventional implicature (Potts 2005) or illocutionary operators (Green 2000).[26] Additionally, Bittner (2014) argues that a dynamic semantics for mood and evidentiality allows a unified semantic approach to temporality across languages that rely on tense (English), aspect (Mandarin) and mood (Kalaallisut) to convey temporal information. While Stalnaker (2014) claims that dynamic semantics blurs a crucial boundary between semantics and pragmatics, we have argued that only dynamic semantics makes it possible to continue drawing that boundary in a principled way that is sensitive to the nuances of cross-linguistic data.

2.4 Discussion: can sentential force be semantic?

It is worth addressing a few objections to treating sentential force as semantic. The first begins with the thought, variously expressed, that there is one-to-one mapping between sentential mood and sentential force. Consider first the possibility that there is a one-to-many mapping. The argument then seems to be that a dynamic pragmatics, but not a dynamic semantics, can allow for some uses of e.g. declaratives to not update the common ground, and do something else instead. However, this argument is not valid, and it is far from clear that the relevant linguistic data exists. It is entirely compatible with a semantic analysis to view the target linguistic structures, such as declarative mood, as systematically polysemous between related update functions. Further, since the common ground is quite frequently distant from common belief — as Stalnaker (2014, 113) himself grants — one must find an utterance of a declarative sentence which does not even make the relevant proposition common ground in this weaker sense. No such examples have been actually produced. The same point applies similarly to interrogatives and imperatives, though the details of the particular context update will matter much more, especially with imperatives which seem to vary so widely in their function.

Consider next the case of a many-to-one mapping between sentence mood and sentential force. This exists with negative imperatives in languages like Greek and Italian (Portner 2016) where they are expressed with non-imperative verbal moods. It is entirely possible to capture such data by assigning an imperative update function to those particular syntactic configurations. This is not particularly unprincipled, since many languages have a distinctive verbal mood for negative imperatives (van der Auwera *et al.* 2008b; Aikhenvald 2010). This 'prohibitive mood' is best seen as a sub-species of the imperative since it is not a distinction all languages make, and it serves a directive function. We grant that any semantic analysis like this needs a detailed study of structures like those in Greek and Italian, but there is no clear argument from their existence to the impossibility of a semantic analysis of sentential force. As is common in the case of semantics, a lot is going to depend on the details.

It is also crucial to clarify that a one-to-many mapping between sentence mood and *utterance force* has no relevance to the prospects for a dynamic semantic analysis. In fact, it is on this point that we agree most with work in dynamic pragmatics, and disagree with Searle's (1969) speech act theory. We agree that utterance force is a thoroughly pragmatic process that takes sentential force as input. Thus a one-many mapping between sentence

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[26] On the basis of different phenomena, others have also proposed that force can be compositionally modified and pursued something like a dynamic semantics to explain this. See e.g. McCready (2005), Davis (2009), Thomas (2014), Krifka (2014), Ettinger & Malamud (2014), Malamud & Stephenson (2015), AnderBois *et al.* (2015), AnderBois (2017). However, these works do not explicitly argue that their phenomena cannot be captured in a dynamic pragmatics, and they may not distinguish sentential and utterance force.

mood and utterance force is to be expected. Roberts (2018, §4.2) misses this crucial distinction in criticizing a semantic account of sentential force: "In addition to these complex many-one correlations between mood and speech act type, in both directions, there are other reasons to take the correlation to be merely pragmatic...".

Roberts (2018, §4.2) presents an additional concern about embedded sentential mood: "embedded uses are not speech acts, have no independent illocutionary force; insofar as the semantics proposed above gives the correct contribution to truth conditions in these embedded uses, then it seems preferable to leave illocutionary force out of the compositional semantics." The concern is that since the embedded uses are not themselves speech acts, they cannot have an independent utterance force to contribute to the compositional semantics. But this concern also conflates sentential force and utterance force. It is one thing to assign a particular update function (sentential force) to a clause, and quite another to assign an utterance force to it. The former can be part of a semantics which treats embedded sentential mood as involving 'local contexts' in the sense familiar from dynamic semantics. For example, updating a context set of worlds c with $A \rightarrow B$ involves assessing B in the local context created by updating c with A even though A is not asserted (Heim 1982). Uses of sentential mood embedded under attitude or speech verbs (Pak *et al.* 2008; Crnič & Trinh 2009; Kaufmann & Poschmann 2013) can be treated as evaluating the embedded clause in the context representing the subject's state of mind or a prior discourse context.[27] Crucially, all of this can be done without saying that there are 'embedded speech acts' (Krifka 2014).[28]

We entirely agree with work in dynamic pragmatics that sentential force is only one aspect of utterance (illocutionary) force. So the mere embedding of sentential force does not count as the embedding of a speech act. Indeed, speech acts and syntactic structures (or their meanings) cannot be embedded in the same sense of that concept. Speech acts essentially involve an utterance force and speaker intention, which are not part of recursive semantic computation. As such, they cannot be embedded in the sense of being located at a sub-sentential level of that computation. Speech acts can only be embedded in other intentional acts, e.g. ordering food at a restaurant, but that is a very different sense of embedding (Goldman 1970).

There's another way of articulating the concern that a semantic analysis of sentential force ties sentence mood too closely to context updates. As Clark & Wilkes-Gibbs (1986) and Clark (1996) detail, common ground is collaboratively maintained. The content of a speaker's utterance only becomes common ground when the hearer acknowledges it, either with explicit cues like *mmhmm* or the implicit assent conveyed by silence. Doesn't a semantic analysis of sentential force blur this crucial aspect of conversation? The answer is a simple *no*. All it shows is that the semantic characterization of sentential force must be more nuanced, as it is in Murray (2014) where declaratives update context by *proposing* an update to the common ground. The actual common ground update comes from the explicit cues, or implicit ascent, of the hearer. While we will abstract from this important nuance here, it is one we regard as essential to any plausible semantic theory of sentential force.

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[27] See Stalnaker (1987) and Heim (1992) for related analyses of attitude verbs, and Bittner (2012, 2011, 2014, Ch.6) for a full dynamic analysis of embedded verbal mood consistent with the general approach taken here.

[28] While our account draws inspiration from Krifka (2014), we aim to show that many of the complexities of that analysis are not necessary. The basic tools of dynamic semantics, added to an account of sentence mood and evidentiality are enough. Many of those complexities are motivated by Krifka's (2014) idea that there are embedded speech acts, and that speech acts are index-shifters. We show that context-shifters are enough, and contend in §4 that the idea of embedded speech acts is not coherent.

Finally, Stalnaker (2014, 87-8,172-3) worries that dynamic accounts blur sentential force and content in a problematic way. More specifically, that they do not allow one to distinguish between the content of an assertion, which is a proposition that can be assessed in many different contexts, and the particular result of updating the current context set with that assertion. This concern is born only from a diet of dynamic semantics limited to Heim (1982). There are many dynamic systems, including the one presented below, that create propositional discourse referents that can do exactly what Stalnaker (2014, 87-8,172-3) is describing. Further, it is possible to have operators in the language which do not do this, such as epistemic modals, and this makes it possible to explain why these structures do not create propositions that can be readily assessed outside their context of use. On closer examination, this worry actually highlights a strength of contemporary research in dynamic semantics.

3 Dynamic Semantics for Mood and Evidentiality

The goal of this section is to provide a minimal dynamic semantics that covers the data from §2.3 by integrating existing analyses of the three major moods, evidentials and conjunction into one system. This suffices to make the key conceptual points of this paper: sentential force is different than utterance force (taken up further in §4), sentential force is compositionally modified by evidentials and connectives, and this compositional process is best modeled in a dynamic semantics. It is not possible here to argue that this integrated analysis can capture all of the data discussed in the different literatures on each sentence type, evidential system, connective or model of context. However, we provide pointers throughout to this broader literature, highlighting the issues at stake between different models of context and the kind of data that calls for refinements of the analysis presented here.

We begin with our model of context in §7. Sections 3.2 and 3.3 present our dynamic semantic account of sentence mood and evidentiality. The full formal system is defined in Appendix A. Section 3.4 discusses a range of related phenomena not analyzed here which are important for any semantic approach to sentential force.

3.1 A Unified Model of Context

Our focus here is specifying the leanest model of context that captures the data discussed in §2.3, while being close enough to the more sophisticated analyses presented in Murray (2014), Starr (forthcoming) and Bittner (2014, Ch.6). These existing analyses can account for slifting, appositives, quantification, disjunction and conditionals, but are more complicated than needed to implement our basic ideas about sentential force.[29]

Our model of context will allow us to identify the set of contextual possibilities c, a set of alternative propositions Q covering those possibilities and a preference relation R over those alternative propositions. But, formally, there is only one set-theoretic object R from which c and Q can be defined. This difference simplifies the semantics for connectives that

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[29] For yet further data, we are open to positing a more complex and separate QUD structure (Roberts 1996) and we are also open to taking the relata of preferences introduced by imperatives to be properties rather than propositions. Indeed, Hamblin (1971), Gunlogson (2003) and Farkas & Bruce (2010) present evidence for a model of context that separately tracks, in addition to the common ground, what each participant is individually committed to for the purposes of the conversation. We will not attempt to compare our model to these others here, as we view them as largely compatible with the general approach taken here.

must combine different kinds of updates — one for each sentence mood, and a variety of evidentials. Our only true substantive difference with the Portner (2004) model of context is our treatment of imperatives. We take the primary effect of imperatives to be the modification of a preference ordering, rather than a TDL.[30] As discussed in Charlow (2010, 2014) and Starr (2010, forthcoming), ordering-based analyses overcome serious limitations of TDL approaches when it comes to imperative disjunctions and conditionals.[31] Although we will eventually construct c and Q from R, we will proceed by saying how we think of each separately, and articulating their role in explaining rational inquiry and communication.

Rational agents acquire information, which allows them to distinguish ways the world might be from ways it isn't. This information can be modeled as a set of possible worlds — namely those not ruled out in their inquiry. One body of information is particularly useful for understanding how linguistic interactions unfold — the context set.

Context Set (c) This is the information agents are mutually assuming for the purpose of the interaction. (Lewis 1979c, Stalnaker 1978) Formally, c is the set of worlds not ruled out by these assumptions: $c = \{w_0, \ldots, w_n\}$

On this model, inquiry progresses by gaining information, which amounts to the elimination of worlds. Consider two sentences A: *Annie sang*, and B: *Bob sang*, just four worlds will do; one for each Boolean combination. Figure 1 depicts the process of gaining the information carried by A. Worlds where a proposition is true are indicated with a capital letter, A; worlds where that proposition is false with a lowercase letter, a. One begins in a state with no
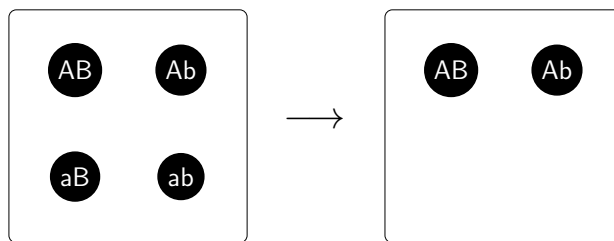
Fig. 1 Gaining the information that A

information about A or B: $\{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}$. When one gains the information that A, all worlds where A is false are eliminated, bringing us to $\{w_{AB}, w_{Ab}\}$.

Of course, communication and inquiry involve much more than just acquiring information. A science or conversation is partly defined by the questions it aims to settle (Bromberger 1966; Roberts 2004). Recent work in epistemology, semantics and pragmatics has illustrated the importance of this fact.[32] A question can be modeled as a set of propositions (Hamblin 1958), namely each proposition that is a complete answer to the question. As we are modeling only polar interrogatives here, all of our cases will involve questions that consist of two

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[30] While Portner (2004, 2007) incorporates the modification of an ordering into his dynamic pragmatics, it is not the primary effect of imperative utterances.

[31] The idea that imperatives dynamically extend partial preference relations originates with van Benthem & Liu (2007) and Yamada (2008). Condoravdi & Lauer (2012) propose a different approach based on preferences that has more in common with modal analyses (Kaufmann 2012) where imperatives communicate information about preferences, rather than directly expressing them.

[32] E.g. Jeffrey (1990), Rooth (1992), Schaffer (2004), Groenendijk (1999) and Roberts (2004).

mutually exclusive and exhaustive propositions, but nothing in the model requires that to be the case. This can be captured by tracking the set of questions that are steering an inquiry.

Question Set (Q) The set of open questions the agents are mutually committed to resolving. Formally, Q is a set consisting of questions (sets of propositions) to be resolved: $Q = \{\{p_0, p_1\}, \ldots, \{p_j, p_k\}\}$.

– Since these are *open* questions, they should be formed by propositions that are consistent with c. In this case, c_R can just be identified with the union of all propositions belonging to some question in Q: $c = \bigcup\{p \mid \exists X \in Q : p \in X\} = \bigcup\bigcup Q$

– A proposition p is an **alternative** when it's a member of some question in Q

For example, suppose again that there are just four worlds ($w_{AB}, w_{Ab}, w_{aB}, w_{ab}$) and the agents have ruled out no worlds so $c = \{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}$. This does not fully specify their progress, if, for example the aim of their inquiry is to know whether Annie sang, in which case the question set would be $\{\{\{w_{AB}, w_{Ab}\}, \{w_{aB}, w_{ab}\}\}\}$. Figure 2 depicts recognizing the question of whether A in the case where there are no previous questions.
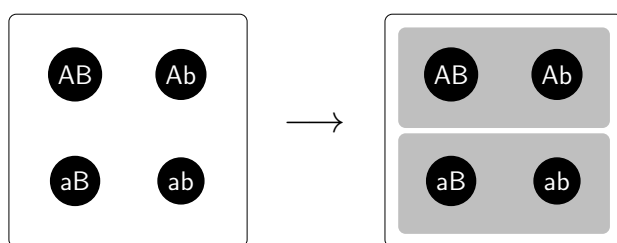

Fig. 2 Recognizing the question whether A

Figure 2 uses sets of sets of propositions as the context. It begins in a state with no information about A or B and only the trivial question (which we do not depict): $Q = \{\{\{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}, \varnothing\}\}$. When the agents recognize the issue that A, worlds where A is true are grouped together and worlds where A is false are grouped together, bringing us to $Q' = \{\{\{w_{AB}, w_{Ab}\}, \{w_{aB}, w_{ab}\}\}, \{\{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}, \varnothing\}\}$. While new questions add new sets of answers to Q, new information will eliminate worlds from those answers. Some technicalities aside, this is Groenendijk & Roelofsen's 2009 model of context.[33] In Figure 2, no information has been added, so no worlds have been eliminated – the context set remains the same, $c = \{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\} = \bigcup Q = \bigcup Q'$.

Following Starr (forthcoming), we adopt one more extension to this picture of inquiry and communication, and so one extension to this model of context. Agents not only gather information and identify questions, they form **preferences** regarding the open alternatives (propositions) they have identified (Hansson & Grüne-Yanoff 2011). This has been one of the driving ideas in thinking about rational decision and choice since Ramsey (1931) and is central to decision theory, as it is applied in philosophy, artificial intelligence (Newell 1992) and economics (Savage 1954).[34] A body of preferences is represented as a binary **preference relation** on alternatives, i.e. a set of pairs of propositions.

Preferences (R) A preference relation R is a binary relation on a set of alternative propositions. It represents the preferences that are mutually adopted for the purposes of the interaction.

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[33] Groenendijk & Roelofsen (2009) builds substantially on Groenendijk (1999) and Hulstijn (1997).

[34] The dynamics of preferences is a more recent topic (e.g. van Benthem & Liu 2007).

– $R(a, a')$: 'a is preferred to a''

For example, suppose again that there are just four worlds ($w_{AB}, w_{Ab}, w_{aB}, w_{ab}$). The preference for A comes out as $\{\langle\{w_{AB}, w_{Ab}\}, \{w_{aB}, w_{ab}\}\rangle\}$: the set containing the pair of A and ¬A. These preferences are illustrated with complementary colors, as in Figure 3, reserving the warm color for the favored alternative.
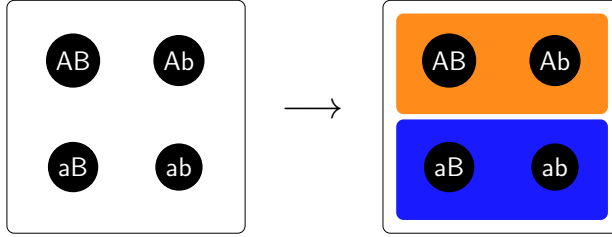

Fig. 3 Coming to prefer A (to ¬A)

The question set Q and context set c are actually implicit in this relation. c_R is the union of all alternatives related by R: $c_R = \mathrm{dom}\,R \cup \mathrm{ran}\,R$. As we will use preference relations, the context set is always an alternative, and is ranked over the empty set, so $\langle c_R, \varnothing\rangle \in R$. This captures the fact that all rational agents will choose to bring about something they take to be possible rather than something they take to be impossible. The question set Q_R reflects this idea: $\{p, q\}$ is a question under discussion just in case $\langle p, \varnothing\rangle, \langle q, \varnothing\rangle \in R$, $p \cap q = \varnothing$ and $p \cup q = c_R$. Intuitively, polar interrogatives make each of their answers possible context sets. Figure 3 illustrates forming a new preference for A over ¬A. Beginning in a state with no information about A or B, and no substantive questions or preferences: $R = \{\langle\{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}, \varnothing\rangle\}$. When no questions or preferences are present, all worlds are ranked over the empty set, as rational agents are committed to choosing actions consistent with their information over actions inconsistent with their information. When we come to prefer that A, worlds where A is true are grouped together and ranked over worlds where A is false, bringing us to $R' = \{\langle\{w_{AB}, w_{Ab}\}, \{w_{aB}, w_{ab}\}\rangle\}$. Crucially, adding a preference does not change the information of the context: $c_R = c_{R'} = \{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}$.

Modeling context this way, as sets of pairs of propositions, encapsulates three kinds of contents: information, questions and preferences. Take for example the initial state which encodes no information, no issues and no preferences: $\{\langle\{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}, \varnothing\rangle\}$. Gaining the information that A, as in Figure 1, involves transitioning from $\{\langle\{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}, \varnothing\rangle\}$ to $\{\langle\{w_{AB}, w_{Ab}\}, \varnothing\rangle\}$. Worlds where A is true are pointwise removed from each set of worlds. Recognizing the question of whether A can be represented as the transition from $\{\langle\{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}, \varnothing\rangle\}$ to $\{\langle\{w_{AB}, w_{Ab}\}, \varnothing\rangle, \langle\{w_{aB}, w_{ab}\}, \varnothing\rangle\}$. Each alternative is preferred over the empty set. Coming to prefer A can be represented as the transition from $\{\langle\{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}, \varnothing\rangle\}$ to $\{\langle\{w_{AB}, w_{Ab}\}, \{w_{aB}, w_{ab}\}\rangle\}$, where A is preferred to ¬A. These effects of gaining information, adopting questions and introducing preferences are summarized in (19).

(19) Gaining information, adopting questions and introducing preferences

$\{\langle\{w_{\mathsf{AB}}, w_{\mathsf{Ab}}, w_{\mathsf{aB}}, w_{\mathsf{ab}}\}, \varnothing\rangle\}$	Gain information that A $\Rightarrow \{\langle\{w_{\mathsf{AB}}, w_{\mathsf{Ab}}\}, \varnothing\rangle\}$
$\{\langle\{w_{\mathsf{AB}}, w_{\mathsf{Ab}}, w_{\mathsf{aB}}, w_{\mathsf{ab}}\}, \varnothing\rangle\}$	Adopt question whether A $\Rightarrow \{\langle\{w_{\mathsf{AB}}, w_{\mathsf{Ab}}\}, \varnothing\rangle, \langle\{w_{\mathsf{aB}}, w_{\mathsf{ab}}\}, \varnothing\rangle\}$
$\{\langle\{w_{\mathsf{AB}}, w_{\mathsf{Ab}}, w_{\mathsf{aB}}, w_{\mathsf{ab}}\}, \varnothing\rangle\}$	Introduce preference for A $\Rightarrow \{\langle\{w_{\mathsf{AB}}, w_{\mathsf{Ab}}\}, \{w_{\mathsf{aB}}, w_{\mathsf{ab}}\}\rangle\}$

3.2 Dynamic Semantics for Sentential Mood

Dynamic pragmatics assumes that the kind of context updates described in the previous section are pragmatic in nature. Since we have argued that they are semantic in nature, we will need to alter the form a semantics takes to model our proposal. In dynamic pragmatics, linguistic meaning is identified with static content: propositions, properties or sets of propositions. But in dynamic semantics, the linguistic meaning of a sentence is identified with its ability to update context. Given our model of context as a preference relation R, the meaning of a sentence ϕ is a function from one relation R to another R': $R[\phi] = R'$. Specifying a sentence meaning $[\phi]$ amounts to saying how R and R' differ. Using this format, we will now outline our basic semantics for imperative, declarative and interrogative mood. It is crucial to note, however, that §3.3 will refine this outline by adding propositional discourse referents to this semantics. The full formal analysis can be found in Appendix A.

Let's return to examples of English declarative, interrogative and imperative sentences, setting aside their Cheyenne counterparts for now. For convenience, we assume that they have the same core proposition A that Annie sang — though a more sophisticated analysis in this framework could relax this convenience.[35]

(20) *Annie sang.*   (21) *Did Annie sing?*   (22) *(Annie,) Sing!*
    Declarative: $\triangleright$A   Interrogative: ?A   Imperative: !A

Our basic analysis of each is summarized in Figure 4.

(20) eliminates each ¬A-world from each alternative (proposition) in the input state R. This update amounts to the following.

Basic Declarative Semantics $R[\triangleright$A$]$: eliminate each ¬A-world from each alternative in R (and if any pair is left with no preferred A-worlds, then eliminate that pair) — see Appendix A for details.

A declarative can never add preferences or questions. The parenthetical part reflects that agents move on once their preferred alternative is incompatible with their information. This predicts that updating with $\triangleright$¬A after ?A will eliminate the corresponding question from $Q_{R[?A]}$. It also predicts that updating with $\triangleright$¬A after !A will automatically make it the case that A is no longer a preferred alternative. As these sequences will be discussed below,

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[35] Many phenomena, including *wh*-interrogatives, tense and the imperative subject require a more sophisticated treatment of the content component of this analysis. Our choice to represent the three sentence moods as applying to the same content is a simplifying assumption, rather than a feature of the analysis. Murray (2014, 2017b) and Bittner (2014, Ch.6) show how a more sophisticated compositional analysis could work within the general style of analysis presented here, and the temporal content of imperatives is explicitly discussed more at the end of this section.
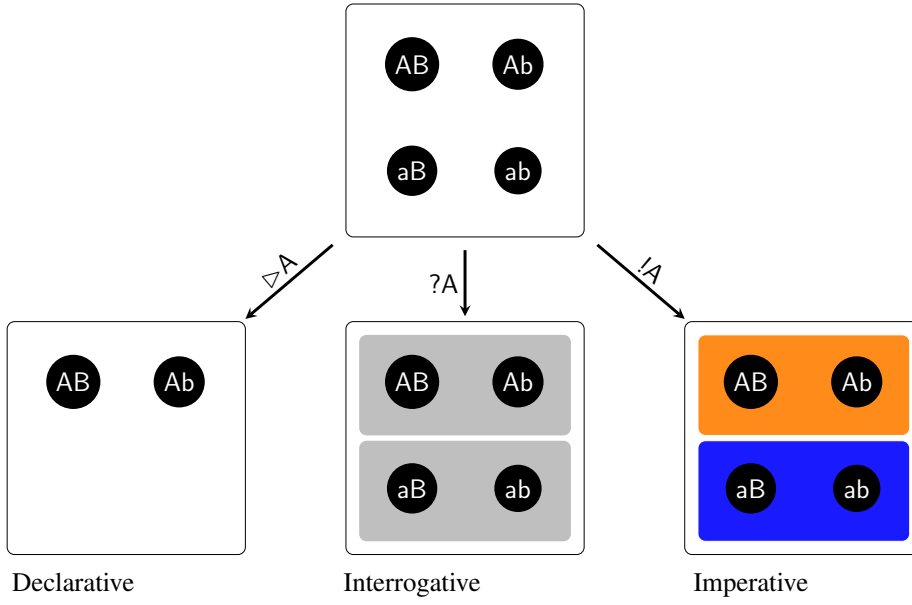
Fig. 4 How Sentential Moods Update Context

a relevant technical detail is worth noting: every non-empty preference relation produced by an update will contain the context set ranked over the empty set. The initial preference relation is $\{\langle W, \varnothing \rangle\}$. Updating this with declaratives will leave the new context set ranked over $\varnothing$ unless the context set is $\varnothing$. If this happens, the parenthetical clause in the declarative semantics will reduce the output state to $\varnothing$, since the corresponding preference would be $\langle \varnothing, \varnothing \rangle$.[36]

Polar interrogative sentences, like (21), add a question consisting of two answers: the contextual A-worlds, and the contextual ¬A-worlds.

Basic Interrogative Semantics $R[?A]$: add a preference for the A-worlds in c_R over $\varnothing$, and a preference for the ¬A-worlds in c_R over $\varnothing$ — see Appendix A for details.

Given the definition of Q_R, this results in adding a corresponding question with these two alternatives. This semantics for interrogatives leaves intact all of the prior information, questions and preferences in R. The imperative sentence (22) differs in that it ranks the positive alternative over the negative one.

Basic Imperative Semantics $R[!A]$: add a preference for all A-worlds in c_R over all ¬A-worlds in c_R — see Appendix A for details.

Crucially, all of the preferences in R are preserved by an imperative update.

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[36] As formulated below, interrogatives and imperatives update by unioning preferences into the preference relation, so they will also preserve the context set being ranked over the empty set. This means that declaratives are the only mechanism for removing pairs, or modifying existing pairs.

In dynamic semantics, *and* is analyzed as sequential update rather than intersecting contents. This allows an analysis of conjunctions like English (23) and Cheyenne (12) where sentential force is compositionally computed.

(23) *I am going to sing and (you) dance!*

English (23) can be translated as $\triangleright A \wedge \, !B$ which amounts to a sequential update with each conjunct: $R[\triangleright A][!B]$. Contrast this to the dynamic pragmatic alternative from §2.3, which required construction-specific pragmatic update rules and also left the semantics of *and* in the awkward position of not applying in these cases. On the dynamic analysis, all one needs to say about conjunction, in all of its occurrences, is said in the compositional semantics. Of course, it is well known that *and* is more restrictive than this dynamic analysis predicts (Txurruka 2003). But this can be captured by adding discourse coherence constraints on top of this dynamic semantics (Txurruka 2003; Asher & Lascarides 2003). Starr (2018) uses this idea to capture the full range of conjunctions of imperatives and declaratives, including those that have conditional readings and those where the imperative does not have a directive sentential force. Starr (forthcoming) shows how to extend this dynamic framework to disjunction and conditionals, making crucial use of the idea that they involve compositionally derived sentential forces.

Treating imperatives and declaratives in one dynamic system not only provides a semantic analysis of hybrid conjunctions like (23), it allows one to investigate the infelicity of data like (Starr forthcoming, §2.2):

(24) a. # Unicorns have never existed, and never will. Bring me a unicorn!
     b. # The door is open. Open the door!

The declarative in (24a) eliminates all worlds where there is a unicorn. The subsequent imperative then ranks the empty set over the context set: $\{\langle \varnothing, c_R \rangle\}$. Conversely, (24b) ranks the context set over the empty set: $\{\langle c_R, \varnothing \rangle\}$. Starr (forthcoming, §3) proposes a pragmatic analysis of why these kind of preference are infelicitous. (24a) violates practical rationality constraints on preferences, while (24b) conflicts with the intended interpretation of the imperative to be action-guiding.

However, sequences similar to (24a) are felicitous, like (25).[37]

(25) Peter is crying. Don't cry, Peter!

Our semantics makes the same prediction for (25) and (24a), which seems incorrect. However, we believe our analysis can be extended to address this example by integrating it with an analysis of the temporal content of imperatives and declaratives — something already suggested by the differences in tense between (25) and (24a).[38] As Davies (1986), Han (1998, 5.3.3), Aikhenvald (2010) and Kaufmann (2012, §3.2.2) survey, imperatives have a future orientation. In (24a), the declarative explicitly rules out even future events where you bring me a unicorn, generating the infelicity. This contrasts with (25) where the declarative only rules out worlds where Peter is not crying at the utterance time. The subsequent imperative can therefore be felicitous because it concerns future events of Peter not crying.

Related examples like (26) also raise important issues.

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[37] We thank Regine Eckardt for raising the important issues around (25) and (26). It is worth noting that these examples raise parallel issues for other analyses as well. For example, Portner (2004) uses a To-Do List to order context set worlds, and both (25) and (26) result in empty orderings.

[38] Kaufmann (2012, §3.2.2) captures this in a modal analysis by explicitly temporalizing the modal proposition and its presuppositions, and captures (24) in terms of the presuppositions of the modal operator used to represent imperatives. Eckardt (2011) also develops a version of the modal analysis on which it is explicitly restricted to future worlds. von Fintel & Iatridou (2017, §4.2) briefly mention the idea of modifying To-Do Lists to capture the future-orienting meaning of imperatives.

(26) Don't cry, Peter! Peter is (still) crying.

Our proposed semantics correctly predicts this to be felicitous, but perhaps not for the right reasons. The imperative ranks Peter-not-crying worlds over Peter-crying worlds. The declarative then removes all Peter-not-crying worlds, reducing the preferred alternative introduced by the imperative to $\varnothing$. However, our semantics for declaratives actually eliminates any pair of the form $\langle \varnothing, p \rangle$, for any proposition p.[39] Essentially, this predicts that the declarative in (26) overrides the preference introduced by the imperative in. While this prediction seems incorrect for (26), it seems correct for (27). Consider a patron addressing a server at a diner where they bake their world famous pies once a day.

(27) Give me a slice of cherry pie, please! (Oh) There's none left.

In (27), it makes sense for the declarative to override the imperative, as the patron's imperative no longer compels the server to give them a slice of cherry pie. What is the difference between (26) and (27)? As with the contrast between (24a) and (25), we think the key difference is the temporal content of the sentences involved. Given the context of (27), the imperative concerns only events of being given a slice of cherry pie in the immediate future. But, the declarative rules out all of those events. An extension of our analysis which captures the temporal content of imperatives and declaratives, and how that content is contextually conditioned, could fully capture this contrast.

3.3 Dynamic Semantics for Evidentiality

As discussed in §2.3, evidentials compositionally modify the sentential force of the declaratives they appear in.[40] This section shows how to capture this fact within the dynamic semantics proposed for sentential mood in §3.2. This will require adding a way of representing the distinction between at-issue and not-at-issue content to our model of context. We will follow Murray (2010, 2014, 2017b) who captures this distinction (at least partially) using propositional discourse referents. This section outlines this enriched model and its applications to evidentials. While the full formal system is defined in Appendix A, we will mention some of the more important technical points in footnotes here.

Evidentials are not a kind of sentential mood — sentences with evidentials are also marked for mood. But, the contributions of sentential mood and evidentials interact. Recall Cheyenne (15), a declarative sentence with a reportative evidential, repeated below as (28). Two propositions are conveyed by (28): the scope proposition A and an evidential proposition B (see §2.3).[41]

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[39] What remains after the declarative is the new context set ranked over $\varnothing$. As mentioned in the presentation of our declarative semantics above, every non-empty preference relation will contain the context set ranked over $\varnothing$. The preference relation before the declarative in (26) is non-empty, so it will contain the context set ranked over $\varnothing$. Updating with this preference relation with the declarative will also rank the new context set over $\varnothing$.

[40] Although our discussion focuses on evidentials in declaratives, we will discuss their occurrence with other moods in footnotes and at the end of the section.

[41] In this section, we will model evidential propositions using a distinct atomic radical like B. This does not capture the obvious relation between the scope proposition and the evidential proposition. The full formalization in Appendix A eliminates this artificiality by defining worlds as settling not just what atomic facts are true, but what evidence each agent possesses. Further, the formal implementation in Appendix A follows Murray (2014) in deriving the speaker-anchoring of evidentials indexically.

(28) *É-ho'sóe-sèstse*   *Annie.*   A: Annie danced
      3-dance-RPT.3SG   Annie   B: The speaker has reportative evidence
      'Annie danced, I hear.'   that Annie danced

The difference in status between these propositions is analyzed as a difference in at-issueness: the scope proposition (A) is at-issue while the evidential proposition (B) is not-at-issue (Murray 2014). This distinction also applies to sentences with appositives, where the appositive contributes not-at-issue content (e.g., Potts 2005). However, unlike appositives or other elements analyzed as contributing a conventional implicature, evidentials can also affect the level of commitment to the scope proposition, discussed above in §2.3 and below. We will develop a dynamic model of at-issueness, combine it with our dynamic semantics for sentential mood and show how it captures this interaction.

Our dynamic model of the at-issue/not-at-issue distinction captures it in terms of *attention*: at-issue propositions are information we are attending to, information central to the purpose of the conversation, while not-at-issue propositions are backgrounded or peripheral.[42] In our basic analysis of sentential mood, this distinction is lost. Assume A is the at-issue proposition and B is the not-at-issue proposition, as in (28). Once both ¬A and ¬B-worlds are eliminated, we have no way of distinguishing the A-information from the B-information – no way of distinguishing at-issue and not-at-issue content. To capture this, we adopt the proposal from Murray (2014) to represent at-issue information with a propositional discourse referent.[43] This coheres with a fully general approach where updates that introduce any kind of discourse referent are updates of attention — they track what is being attended to, and their relative prominence (Bittner 2011, 2014).

To capture attention to propositions, we will extend the preference relations introduced in §3.2 to **preference states with attention**. These consist in a preference relation R and a list of propositions being attended to: $S = \langle R_S, d_S \rangle$. The second element — the *propositions under discussion* — is simply a list of propositions: $d_S = \langle p_0, \ldots, p_n \rangle$, where a proposition is a set of worlds. We represent these propositions separately from R_S because they are not generally subsets of the current context set, and R_S does not capture the relative prominence of various propositions.[44]

In this extended model, the distinction between informative at-issue and not-at-issue updates is this: both eliminate worlds from the context set c_R, but at-issue updates also add their propositional content to the propositions being attended to.[45] Thus, we can separate what information is entailed (asserted) from what information is being attended to (at-issue); as shown below, this is crucial for the analysis of evidentials.

We can now outline an analysis of sentences with evidentials. Consider Cheyenne (29), a declarative sentence with a direct evidential. Let A be the scope proposition (at-issue) and B be the evidential proposition (not-at-issue).

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[42] Simons *et al.* (2011) define at-issueness in terms of the QUD, while we are treating it as an unanalyzed primitive here. We are concerned primarily with how at-issueness effects the dynamics of conversation, not with whether at-issueness can be reduced to other constructs like the QUD. We leave this important question for other work.

[43] Also see Murray (2014) for a discussion of cases where propositional discourse reference and at-issueness may come apart.

[44] As discussed in Appendix A, the current context set is always the last member of d_S and at-issue propositions are always appended to the front. In this section, we will omit reference to the context set in depictions of d_S as it does not matter for the explanations given here.

[45] On this model, the only difference between these updates is in attention: whether or not a propositional discourse referent is introduced. Murray (2010, 2014) makes a further distinction: not-at-issue updates directly change the common ground, while at-issue updates are first proposed to change the common ground.

(29) *É-ho'soo'e-∅ Annie.* A: Annie danced
     3-dance-DIR Annie B: The speaker has direct evidence that
     'Annie danced (I witnessed).' Annie danced

Cheyenne (29) will be translated as $\triangleright_d$ A. For simplicity, we analyze the direct evidential and declarative mood as fused into a single operator ($\triangleright_d$). However, from the technical implementation in Appendix A, Definitions 12–14, it will be clear how to relax this simplification.[46] This is still a declarative sentence, and still performs a declarative-like update ($\triangleright$) that eliminates ¬A-worlds, just like the English sentences discussed in §3.2. But the meaning of $\triangleright_d$ A can now be separated into three parts, illustrated in Figure 5, and detailed below:

Direct Declarative Update $S[\triangleright_d A]$:
1. *Evidential Restriction*: context set is restricted to B-worlds (speaker has direct evidence that *A*) by eliminating all ¬B-worlds from each alternative in R_S
2. *Attention Update*: attend to scope proposition by putting $[\![A]\!]$ at the front of d_S
3. *Scope Update*: context set is restricted to A-worlds by eliminating all ¬A-worlds from each alternative in R_S

It is important to note that these are illustrated and presented as separate, ordered steps but this is only for the sake of presentation.
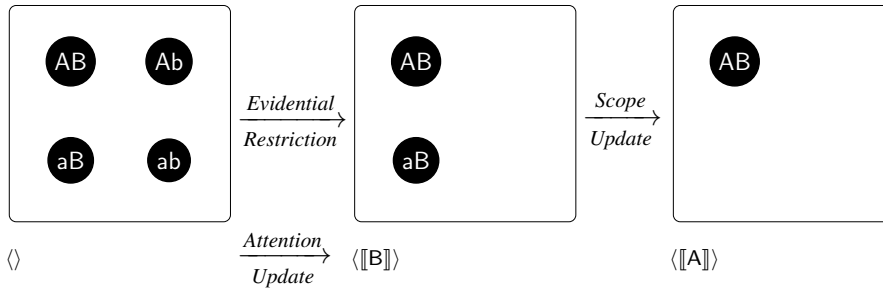
Fig. 5 Analysis of Cheyenne Direct Declarative (29): $\triangleright_{dir} A$

In Figure 5, the initial state S is $\langle R, \langle \rangle \rangle$, where $R = \{ \langle \{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}, \varnothing \rangle \}$ and the list of propositional discourse referents is empty ($\langle \rangle$). State S updated with $\triangleright_{dir} A$, $S[\triangleright_{dir} A]$, is $S' = \langle R', \langle [\![A]\!] \rangle \rangle$, where $R' = \{ \langle \{w_{AB}\}, \varnothing \rangle \}$. The truth conditions for (29) are that A is true and that B is true: that Annie danced and that the speaker has direct evidence that Annie danced. But unlike that English conjunction, only the first conjunct is being actively attended to. This predicts that only $[\![A]\!]$ will be automatically accessible for propositional anaphora. This, in turn, can account for the direct challengeability data: direct challenges like *That's not true, you didn't see her dance* to (29) are infelicitous because the propositional anaphor *that* is trying to access a propositional discourse referent that is not being attended to.

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[46] Murray (2014) gives a fully compositional analysis along the lines proposed here, offering the following decomposition. Declarative mood both updates the context set and adds a propositional discourse referent, using the meaning of its scope. Evidentials can modify the meaning of the scope in a way that alters the context set update, but not the propositional discourse referent. Reportative evidentials weaken the context set update to being only the information that the speaker has reportative evidence that the scope proposition is true. Direct evidentials strengthen the context set update by adding to it the information that the speaker has direct evidence that the scope proposition is true.

A parallel analysis can be given for declarative Cheyenne sentences with reportative evidentials, as in (28), with one important difference: they do not make any commitment to the scope proposition. That is, Cheyenne (28) does not require that Annie danced, or even that Annie having danced is possible. In fact, the scope of a reportative can be explicitly denied (see (18)). Again let A be the scope proposition (at-issue) and B be the evidential proposition (not-at-issue). Cheyenne (28) will be translated as $\triangleright_{\mathsf{rpt}} A$ — though like direct evidentials a compositional analysis is possible, see note 46. $\triangleright_{\mathsf{rpt}} A$ makes three updates to S, illustrated in Figure 6, and detailed below:[47]

Reportative Declarative Update $S[\triangleright_r A]$:
1. *Evidential Restriction*: context set is restricted to B-worlds by eliminating all ¬B-worlds from each alternative in R_S
2. *Attention Update*: attend to scope proposition by putting $[\![A]\!]$ at the front of d_S
3. *Scope Update*: context set is trivially restricted to $A \vee \neg A$-worlds

Unlike with the direct evidential, the ¬A-worlds are not eliminated: we keep both A-worlds and ¬A-worlds — this is how reportative evidentials modify the sentential force of declaratives they appear in. This is what makes a follow-up like (18) felicitous. In Figure 6, as in
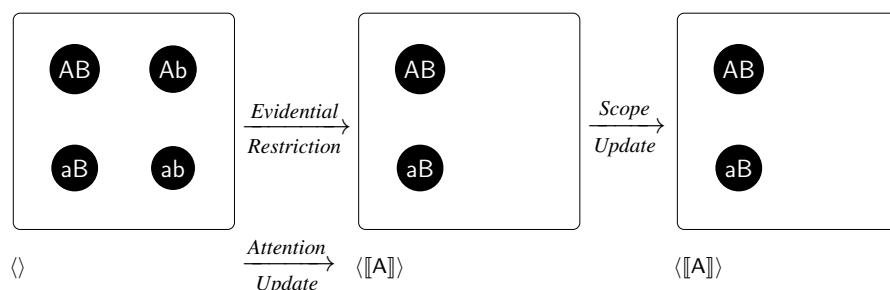
Fig. 6 Analysis of Cheyenne Reportative Declarative (28): $\triangleright_{\mathsf{rpt}} A$

Figure 5, the initial state S is $\langle R, \langle \rangle \rangle$, where $R = \{ \langle \{w_{\mathsf{AB}}, w_{\mathsf{Ab}}, w_{\mathsf{aB}}, w_{\mathsf{ab}}\}, \varnothing \rangle \}$ and the list of propositional discourse referents is empty ($\langle \rangle$). State S updated with $\triangleright_{\mathsf{rpt}} A$, $S[\triangleright_{\mathsf{rpt}} A]$, is $S' = \langle R', \langle [\![A]\!] \rangle \rangle$, where $R' = \{ \langle \{w_{\mathsf{AB}}, w_{\mathsf{aB}}\}, \varnothing \rangle \}$. The truth conditions for (28) are simply that B is true — that the speaker has reportative evidence that Annie danced. But unlike that English re-description, (28) does not draw attention to the proposition $[\![B]\!]$. Only the proposition $[\![A]\!]$ is being attended to and thus automatically accessible for propositional anaphora.

Reportative evidentials present the at-issue content (A) without committing to it (Faller 2002). Following Murray (2014, 2010), our dynamic semantic analysis of sentential mood and evidentials captures this as a variation on ordinary declarative updates. On the account proposed here, declarative sentences with evidentials are given a unified analysis – they are all declarative sentences. They all make commitments to propositions and draw attention to propositions, but the evidential can affect what the commitments are. This provides a straightforward semantic analysis of evidentials that does not have the significant theoretical costs of others. More specifically, previous accounts have made compromises to either

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[47] Rendering the scope update of reportatives as trivial restriction allows a unified theory according to which all evidentials places some restriction on the context set. It is not crucial that disjunction, specifically, is used to achieve this trivial restriction.

analyze evidentials at the level of utterance force (speech acts) or at the level of static semantic content. Faller (2002) analyzes reportatives in a speech act theory framework and posits a new primitive kind of speech act for them to express. Speech act theory, of course, problematically blurs utterance force and sentential force, and there is little motivation to think of reportative sentences as performing a fundamentally new kind of speech act. Matthewson *et al.* (2007) analyze evidentials as modals and so build their effects into the traditional static content of sentences. However, Matthewson *et al.* (2007) are forced to treat the evidential restriction as a presupposition, even though that information is often new to the discourse, and forced to say that there are two fundamentally different kinds of evidentials: modal evidentials and illocutionary evidentials. By treating evidentials as dynamic modifiers of sentential force, our analysis avoids these costs and provides a unified framework for analyzing the differing behavior of evidential systems from St'àt'imcets (Matthewson *et al.* 2007) to Cuzco Quechua (Faller 2002) to Cheyenne (Murray 2010). In short, recognizing sentential force as part of compositional semantics avoids the compromises other accounts have made in order to fit evidentials into frameworks suited to utterance force (speech act theory) or static semantic content.[48]

While this section has focused on the role of attention updates for evidentials, we are actually proposing that all sentential moods involve an attention update: declarative, interrogative and imperative mood introduces a discourse referent for their core content — see Definitions 10 – 12 in Appendix A. This assumption makes welcome predictions for interrogatives and imperatives as well as declaratives. Starr (2018) uses this idea about imperatives as a crucial part of analyzing the conditional meaning that arises in some conjunctions of imperatives and declaratives. For interrogatives, it allows one to capture data highlighted by Krifka (2001). Treating polar interrogatives as denoting a set consisting of their two answers (Hamblin 1958) predicts that (30a) and (30b) denote the same set.

(30) a. Did Annie dance?
　　 b. Didn't Annie dance?

But a *yes* reply to (30a) means the opposite of what it does to (30b). As Krifka (2001) points out, this is problematic for the sets of answers analysis of interrogatives. However, on our account of interrogative mood, (30a) and (30b) will introduce different propositional discourse referents. (30a) will introduce $[\![A]\!]$ while (30b) will introduce $[\![\neg A]\!]$. Thinking of *Yes* as a propositional anaphor following Krifka (2013) and Roelofsen & Farkas (2015), this account predicts that it will mean something different as reply to (30a) and (30b). So the general hypothesis explored here that sentential mood introduces propositional discourse referents provides an interesting tool useful for a range of data unrelated to our original discussion in §2.3.[49]

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[48] It is worth noting that although AnderBois (2014) gives a pragmatic account of how reportative evidentials are consistent with denying their scope proposition, that pragmatic explanation assumes a semantic treatment of sentential force, and also assumes that evidentials modify that force — just in a different way than proposed above. While we worry that the 'pragmatic perspective shift' account of AnderBois (2014) is too unconstrained, this issue of detail does not impact our broader points here that sentential force requires a semantic analysis in part because evidentials modify it.

[49] The analysis sketched here is one way of implementing the *highlighting* style of analysis proposed by Roelofsen & van Gool (2010). This phenomena can also be captured by singleton set analyses like Biezma & Rawlins (2012). We take no stand on what the best particular analysis of interrogative mood is. We are merely noting that the system outlined here can implement a *highlighting* analysis with an independently motivated resource from evidentials. It is also possible to implement a singleton set analysis by having ?A only rank the A-worlds in the context set over ∅, and refining the definition of Q_S.

3.4 Discussion

We have focused on very basic data involving sentential mood, evidentials and conjunction. But this leaves open a number of important questions about more complex data, specifically: evidentials in non-declarative sentences, infelicitous mixed-mood conjunctions and the interaction of intonation and sentential force, e.g., rising declaratives. This short section will describe this data and analyses of it, and discuss the prospects of adapting the account offered above to cohere with these analyses. While there is much work to be done, we will suggest that the leading ideas on these phenomena all cohere well with a semantic analysis of sentential force and in some cases lend further support to such an analysis.

Many languages, including Cheyenne, allow evidentials in non-declarative sentences, and produce a range of meanings from these combinations. Murray (2017b, Ch.5) discusses how evidentials interact with interrogative mood, and formulates an analysis consistent with that here. Aikhenvald (2010, 138), Schwager (2010), Thomas (2014) and AnderBois (2017) explore the interpretation of imperatives with reportative evidentials across several languages. While Thomas (2014) and AnderBois (2017) give alternative analyses, both fit broadly within the approach outlined here. Thomas (2014) argues that imperative mood embeds under reportative evidentials in Mbyá, and argues that the corresponding sentences report a command and thereby neutralize any directive force from the imperative. Thomas (2014) analyzes this in Krifka's (2014) semantic framework. That framework assigns functions from speech events to speech events — thought of as embedded speech acts. This can be modeled in a dynamic semantics like ours as functions from states to states. As discussed above, this is preferable anyway since only sentential force, and not utterance force (speech act type), can be associated with sentence types. AnderBois (2017) argues that reportative evidentials in Tagalog and Yucatec Maya involve normal imperative updates which are modified by the reportative evidentials, and implements this in a dynamic semantics broadly in line with our semantics in §§3.2 and 3.3. Although these analyses disagree about how best to understand imperative sentences with reportative evidentials, both assume a semantics that features imperative updates that are modified by reportatives — that is, a dynamic semantics broadly in line with that proposed here.

Sentence mood interacts with intonation in ways that are crucial for any theory of sentential force. Our discussion of English has concerned only declaratives with falling intonation ($\downarrow$) and interrogatives with rising intonation ($\uparrow$), and has not said whether the associated context updates are associated with the purely formal features of these sentences, their intonation, or a combination of the two. Settling this issue is crucial since there is compelling evidence that the associated updates are a complex result of intonation and form. This comes out in rising declaratives (Pierrehumbert & Hirschberg 1990; Gunlogson 2003). While both (31a) and (31b) are declarative sentences, the rising intonation contour ($\uparrow$) of (31b) generates an interrogative-like sentential force since it can license *yes*/*no* responses.

(31) a. Annie won$\downarrow$.
     b. Annie won$\uparrow$?

Further, falling interrogatives (32a), and rising (32b) and falling (32c) tag questions illustrate the variety that a sophisticated analysis must address.

(32) a. Did Anne win$\downarrow$?
     b. Anne won, didn't she$\downarrow$?
     c. Anne won, didn't she$\uparrow$?

Recent work on these constructions have revealed a number of crucial contextual effects that distinguish each type of sentence which any analysis must capture (e.g. Malamud &

Stephenson 2015; Farkas & Roelofsen 2017; Jeong 2018). Does this more complex relationship between sentence mood and context update call into question the general semantic approach to sentential force adopted here? We will suggest that it does not.[50]

From seminal studies like Gunlogson (2003) and Pierrehumbert & Hirschberg (1990) to more recent work like Malamud & Stephenson (2015), Farkas & Roelofsen (2017) and Jeong (2018), it is assumed that declaratives and interrogatives are associated with dynamic conventions of context change that intonation can modulate — primarily in terms of expressing the speaker's expectations about or commitments to the associated proposition. However, those conventions have not always been thought of as part of *compositional semantics*. Gunlogson (2003, §3.2) explicitly adopts a dynamic semantic approach to sentence force which compositionally arrives at the different updates performed by (31a) and (31b). This approach assumes that all English sentence forms are marked not just for mood (declarative/interrogative) but also 'open/closed'. While word order indicates the former, intonation indicates the later. Dynamic semantic conventions are formulated for each, which can compositionally determine their different effects in a suitably rich model of context. But, more recent work addresses empirical limitations of Gunlogson (2003). Interestingly, these accounts separate compositional semantics from 'conventions of use' (Malamud & Stephenson 2015; Farkas & Roelofsen 2017; Jeong 2018). These conventions of use are akin to the Dynamic Pragmatic Principles but include further rules that say how to update the context, given a particular content, sentence type *and* intonation contour. Unlike Portner (2004) and Roberts (2018), it is taken for granted in this work that these rules cannot be grounded in purely pragmatic reasoning, and are truly conventional.[51] For example, Farkas & Roelofsen (2017) provide one convention for falling declaratives and rising interrogatives, one for rising declaratives, one for rising tag interrogatives and one for falling tag interrogatives. Given the discussion of §2.3, it is crucial to consider whether these conventions of use must be recursively applied in sentences with connectives.

Someone talking to a friend about entering a eating contest might utter (33a) in the process of thinking through entering and realizing that Annie, who is a very strong contender, might enter. (33b) might be uttered instead if the speaker knows that Annie entered, but is looking for confirmation that Annie will likely win.

(33) a. I'm going to enter the contest↓ or did Anne enter↓?
　　　 b. Annie entered↓ and she will win, won't she↑?

The conventions formulated by Farkas & Roelofsen (2017) do not cover these cases, but it would be easy to cover them if the conventions of use were simply part of the dynamic meaning of sentences, and connectives are given suitable dynamic meanings. There are no obstacles to doing so, and there are clear empirical gains.[52] Indeed, Ettinger & Malamud (2014) end up doing just this in their semantics for Mandarin *ba* (吧) which interacts with

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[50] We thank Craige Roberts for emphasizing the importance of these phenomena for our semantic treatment of sentential force.

[51] It is, however, somewhat confusing to call them 'conventions of use'. That term originates with Morgan (1978) and Morgan (1978) uses that term only for conventions that 'shortcut' genuinely pragmatic reasoning.

[52] It should be noted that such an account would not fit nicely into the theoretical landscape sketched by Farkas & Roelofsen (2017, §2). They assume that accounts either treat intonation and mood as semantically encoding particular ways of updating the context with a proposition radical (Farkas & Roelofsen 2017, §2.2) or that intonation and mood impact traditional semantic content *and* the application of non-semantic rules of use (Farkas & Roelofsen 2017, §2.3). However, on the kind of semantics proposed here, sentential force modifiers can effect both the content that's being added to the context, and the particular kind of update being performed. Interrogatives add more content than their proposition radical (the negative answer) and evidentials can both modulate the proposition radical (as in reportatives) and add content of their own (the evidential proposition).

context much like rising intonation in English, noting that this is needed to cover complex sentences. Executing such a full dynamic semantic analysis of sentential mood and intonation is clearly beyond the scope of this paper, but we hope to have shown that the prospects for such an analysis are good.

This most recent appeal to sentences with connectives renews a question that must be asked of our account. While it is clearly possible to combine different sentential forces with connectives, even we must grant that not all combinations produce coherent and meaningful sentences. Isn't this negative data just as important to explain, and isn't dynamic pragmatics on better ground here? In short: no. The fact that any positive examples exist shows that we must have a syntax which allows these constructions and a semantics which can interpret them. It is up to a semantics for the connectives and a discourse pragmatics to explain why some combinations are anomalous. And, it is not hard to see how that account would go. Work on connectives in natural language has revealed that connectives are lexically constrained to certain discourse relations holding between the clauses they combine (e.g. Txurruka 2003), and that connectives differ across languages in which discourse relations they are consistent with (Murray 2017a). A pragmatic theory of discourse coherence is independently needed to explain the meaning and limitations of sequencing two speech acts $\alpha_1; \alpha_2$, for each possible pair of sentence types that α_1 and α_2 could be instances of — even dynamic pragmatics must grant this. Together, any such analysis of a connective and any such theory of discourse coherence predicts which complex sentences will yield coherent interpretations. While we are very far from offering such an analysis, it follows from two independently needed theories, and so should not be thought of as a special cost for the semantic approach taken here.

4 From Sentential Force to Utterance Force

Our semantic account of *sentential force* is not an attempt to build utterance (illocutionary) force into the semantics of sentences. We will now clarify that by discussing the properly pragmatic phenomenon of utterance force.[53] We do so by describing the leading pragmatic analyses of utterance force and showing that a semantic treatment of sentential force is compatible with them. We will also explain some important consequences of these approaches for empirical phenomena involving 'force modifiers' or 'illocutionary operators'.

It is worth recalling some of the main points from §2.1 about the distinction between sentential and utterance force. Consider the particular sentential force associated with declaratives and the utterance force of assertion. Declarative sentential force consists, at least partly, in updating the common ground with a proposition. As Stalnaker (2014, 113) observes, updating the common ground with a proposition is an effect common to different speech acts like asserting, stating, conjecturing, pretending and so forth, and can also be achieved via non-linguistic means, as when everyone perceives a goat walking into the room (Stalnaker 1978, 86). This highlights three key theoretical questions that theories of utterance force (and communicative acts) aim to address:

Constitution   What effects, in addition to sentential force, do different utterance forces, e.g. assertion, consist in?

Mechanism   By what pragmatic mechanisms are these effects produced?

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[53]   We prefer the term *utterance force* here to *illocutionary force*, since the latter has been used differently by Austin (1962), who takes it to be non-semantic, and Searle (1969), who takes it to be semantic. As utterances are the explicit domain of pragmatics, we think this terminology more clearly conveys the key distinction.

Taxonomy Are there natural classes of utterance forces (communicative acts)? If so, what are they?

We will set aside Taxonomy here. Attending to Constitution and Mechanism will help distinguish the various analyses of utterance force that have been proposed.

Neo-Gricean approaches like Bach & Harnish (1979, 42) identify utterance forces with intuitive divisions between speech acts (e.g. assertions, commands, requests, etc.). These utterance forces are constituted by particular communicative intentions and recognized by the standard mechanisms of Gricean pragmatics: cooperative intention recognition. For example, they take a speaker S's utterance e of *Janis was a singer* to H to count as an assertion roughly when:[54]

(34) By uttering e, S intends H to recognize that:
    a. S believes that Janis was a singer and
    b. S intends H to form this same belief

Bach & Harnish (1979, 42) explain in detail how the particular content of (34) is inferable from the sentence's semantics, world knowledge applicable to the envisioned context and certain pragmatic principles. More generally, Neo-Gricean analyses begin with the premise that S performed e, and use e's mood and semantic content to constrain the range of attitudes that it could be expressing. This makes it possible to discern the content of the (34a) component and the attitude referenced in the (34b) component. This pragmatic inference allows H and S to mutually recognize (34), in which case a successful assertion has been made.[55]

It is useful to see that, on this model, uttering the same sentence could generate a distinct utterance force when different mutual contextual beliefs are in place. As Bach & Harnish (1979, 43) detail, this utterance could be interpreted instead as a suggestion when there are different mutual contextual beliefs. For example, suppose S and H are playing a trivia game in which they have to guess Janis' profession. It's common ground that neither really knows, but that S has some relevant evidence while H does not. Further, H must write down an answer. In this context, a different communicative intention will be conveyed:

(35) By uttering e, S intends H to recognize that:
    a. S believes that there is reason, but not sufficient reason, to believe that Janis was a singer and
    b. S intends H to form this same belief

It's crucial to note how the semantic contribution of declarative mood nevertheless remains constant here: it indicates that the speaker is expressing an intention about a *belief* and that the content of the belief corresponds to the scope of declarative mood.

To be sure, there are many more recent and more sophisticated Neo-Gricean analyses. But they preserve the relationship between sentential force and utterance force in the Bach & Harnish (1979) analysis. Roberts (2018) offers an improved account of how utterance forces are inferred from context and sentential force, by offering a better model of context and relevance. Cohen & Perrault (1979) and Cohen & Levesque (1985, 1990) formulate the inferences in a rigorous formal logic, but this only serves to more rigorously highlight the way that sentence mood is assumed to constrain the pragmatic inference to an utterance force. More recent pragmatic work on the illocutionary heterogeneity of imperatives (Davies 1986; Portner 2012; Condoravdi & Lauer 2012; Roberts 2015, 2018) also fits this mold.

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[54] Additional qualifications ensure that the utterance is literal, communicative and that the intention in (34) is appropriately transparent and recognized in the right way (Bach & Harnish 1979, §1.6).

[55] Note that (34a) and (34b) need not themselves be actually true for a successful assertion on this account.

Work in dynamic pragmatics like Hamblin (1971), Gazdar (1981) and Farkas & Bruce (2010) develop models of context which explicitly track, in addition to mutual commitments like the common ground, the kind of hearer and speaker commitments highlighted in the Neo-Gricean analyses sketched above. These models make it particularly easy to see how our dynamic semantics for sentential force can be integrated with a Neo-Gricean analysis of utterance force. An utterance of a declarative *Janis was a singer* will add the corresponding proposition to the common ground — that is its sentential force. But it will also invite the hearer to perform a pragmatic inference that depends on contextual assumptions. In some contexts an assertion will arise, which results in the proposition that Janis was a singer to *S*'s discourse commitments, along with the proposition that *H* should believe this proposition. The details of this inference, and the particular speaker and hearer commitments they involve, need to be rigorously examined and justified. But that is not our task here. We are merely observing that the semantic analysis proposed here can draw on the rich existing literature on this topic rather than starting anew.

There is, however, a prominent alternative to Neo-Gricean analyses of utterance force. A number of theories focus on a different mechanism, namely collective behaviors like social conventions or constitutive rules. These accounts maintain that the force of an utterance is determined by constitutive rules or social conventions governing the utterances of particular kinds of sentences in particular contexts. These rules parallel those in games such as chess which say how particular pieces may move given the state of the game, and how this move determines the next state of the game. For example, Austin (1962) holds that uttering *I bet you sixpence it will rain tomorrow* counts as a bet in virtue of a convention which specifies certain conventional effects of uttering a sentence of the form *I bet X* in particular contexts, and licenses certain subsequent moves like demanding money.[56] Unlike Searle (1969), Austin (1962) sharply distinguishes these social conventions from those that govern the linguistic meaning of words.[57] The rule for assertion might say that the speaker counts as being committed to believing the semantic content of the assertion, and that the speaker should believe it as well. Analyses of this general kind have been developed by Stenius (1967), Lewis (1979b), Brandom (1983) and Kukla & Lance (2009), and various passages of Stalnaker (2014) can be read as advocating for a theory of this kind.

What's crucial to note about the constitutive rule account is that it differs from the Neo-Gricean account in the mechanisms, but not necessarily in the effects that constitute utterance force. This means it is still possible to capture the dynamics of utterance force using models like Hamblin (1971), Gazdar (1981) and Farkas & Bruce (2010) even if the mechanism driving those dynamics is not taken to be exclusively a matter of rational, cooperative agents exploiting communicative intentions. Given our approach to sentential force, the constitutive rules of utterance force will specify consequences of applying a particular sentential force to the context (our preference states for attention) given particulars about the speaker, hearer, sentence form, etc. These consequences will consist in particular discourse commitments for the speaker and hearer.

Murray & Starr (2018) develop an analysis that focuses on a different kind of collective behavior: social norms. While granting important roles for communicative intentions and social conventions, Murray & Starr (2018) argue that social norms are the key mechanism that generates utterance force. This argument is formulated by drawing on analyses of social

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[56] See also seminal discussions of language games in Wittgenstein (1953) and Sellars (1954).

[57] While Searle (1969) distinguishes linguistic and social rules, his analysis blurs them by allowing expressions like logical operators governed by linguistic conventions to operate on expressions to which social conventions apply (illocutionary force operators). This amounts to the problematic blurring of the distinction between utterance force and sentential force discussed in §2.1.

conventions and social norms in game theory (Lewis 1969; Bicchieri 2005), and work in social philosophy, sociology and animal communication to show that only social norms can facilitate communication in the face of prevalent conflicts of interest between speakers and hearers. Murray & Starr (2018) develop a dynamic pragmatic model of utterance force that is explicitly integrated with the approach to sentential force offered in this paper. Murray & Starr (2018) also suggest that this integrated account can easily capture the hybrid utterance forces generated by hybrid sentences highlighted here: *I love you and don't you forget it*. Since Neo-Gricean accounts infer utterance forces holistically from an utterance, it is not clear they can capture this.[58] Similarly, social convention approaches seem to require distinct conventions for each of the indefinitely many forms that hybrid sentences can take. Murray & Starr (2018) contend that social norms govern how mutual commitments bear on private commitments, rather than the utterance of particular sentence forms, and show how this aids the pragmatic generation of complex utterance forces.

Surveying these analyses of utterance force charts a course from the analysis of sentential force developed in §3 towards a fuller analysis of speech acts. But it also sheds some light on two delicate conceptual issues. As Figure 7 depicts, the leading theories of utterance
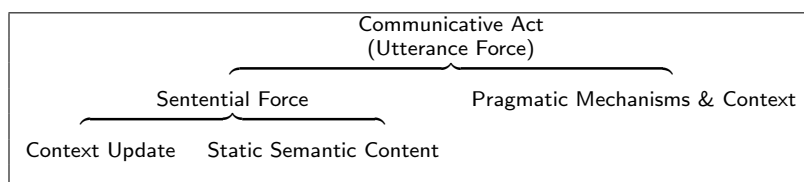

Fig. 7 The Structure of Communicative Acts

force take it to be determined by sentential force *and* pragmatic mechanisms.

While we hold that sentential force is directly encoded in dynamic linguistic conventions, dynamic pragmatists take it to be determined via pragmatic inference and static semantic type. But, on both accounts a conservative thesis about utterance force holds:

The Linguistic Modification Thesis (LMT)

Linguistic material can only influence utterance force by influencing sentential force.

Focusing on LMT can help organize the burgeoning literature on a variety of particles and structures that have been called 'force modifiers' or 'illocutionary operators'. According to LMT, an operator like ▷, and its natural language correlates, is not an *assertion* operator — it would be better to simply call it a declarative mood operator. Consider also adverbial constructions like (36) where the adverbial intuitively modifies the utterance event itself (e.g. Bach & Harnish 1979, Potts 2005, §4.7.3, McCready 2008, Krifka 2014, §3).

(36) a. Frankly, Cooper is gorgeous.
     b. Again, Cooper is gorgeous.
     c. Man, Cooper is gorgeous.

LMT permits an analysis on which these adverbials generate a complex sentential force by modifying the sentential force associated with declarative mood. This change to sentential

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[58] It is worth noting that Neo-Griceans such as Horn (1984), Levinson (2001) and Simons (2011) embrace embedded implicatures of some variety. Since these theorists do not explicitly discuss utterance force, it is unclear whether their analyses extend to this phenomenon.

force could indeed lead to a different utterance force. But LMT does not permit an analysis on which these adverbials *directly* modify utterance force. If an empirical case could be made for such a direct link between these adverbials and utterance force, then LMT would be undermined. But rejecting LMT comes with a cost: explaining how these particles directly modify utterance force while addressing the radical under-determination of utterance force by linguistic form. It is therefore appealing to also investigate an analysis where these adverbials modify sentential force, rather than utterance force.

A related point applies in the literature on evidentials, where it has become common to describe some evidentials as 'illocutionary' and others as 'epistemic' or 'modal'. It is well-established that there are empirical diagnostics which distinguish these kinds of evidentials. But this empirical diagnostic is sometimes assumed to show that some evidentials are best analyzed as modals (Matthewson *et al.* 2007) and others that are best analyzed as illocutionary operators (Faller 2002). However, if LMT is correct, there are no illocutionary operators. At most, evidentials can modify sentential force. Sentential force can either be modified by altering *the content* that updates a context, or by altering *the way* a content updates a context, or by modifying both. A unified analysis of all evidentials is therefore possible by allowing variation across languages, and evidentials, in whether they modify content, updates or both. That is the kind of unified analysis pursued by Murray (2014, 2017b), on which our analysis here has been based.

LMT also helps sharpen the debate between dynamic semantic and dynamic pragmatic analyses of sentential force. When a given morphosyntactic unit modifies sentential force, is it best modeled as doing so by semantically modifying a context update, or by modifying static semantic content involved in a pragmatic context update? Focusing on this question, and clarifying the nature of force modification, may prove useful in the implementation of cross-linguistic theories of force.

5 Conclusion

Human communicative acts serve to coordinate the commitments of speaker and hearer by changing the information, questions, preferences and state of attention they are mutually assuming for the purposes of their exchange (i.e. 'the context'). We have divided this into two components: sentential force and utterance force. Sentential force was argued to be best explained in terms of a dynamic semantics for declarative, interrogative and imperative mood (§2). This argument was made on empirical, methodological and philosophical grounds. We argued that the kinds of context updates that constitute sentential force cannot be grounded in purely pragmatic reasoning (2.2). Further, we argued that a dynamic pragmatic analysis must explain the compositional behavior of sentential force with connectives and other operators, and that this requires a controversial assumption: pragmatic reasoning can be recursively applied in accord with syntactic structure (§2.3). In §3, we showed that a dynamic semantic analysis of sentential mood and evidentiality can do without this controversial assumption. This analysis was connected to theories of utterance force in §4, where it explained how utterance force is still a throughly pragmatic phenomena even if sentential force is not. Along the way, we have empirically and conceptually refined the distinction between sentential force and utterance force and emphasized its role in the analysis of communicative acts. Among these consequences is the Linguistic Modification Thesis, which may provide a useful target for future discussion of force modifiers in natural language.

A Dynamic Logic of Mood and Evidentiality (DLME)

Remark 1 The system of DLME defined below extends Starr's (forthcoming) Dynamic Logic of Mood (DLM) to evidentials. (While Starr's (forthcoming) DLM does not explicitly represent polar interrogatives, adding Definitions 1.8 and a simplified version of 11 would achieve that.) At the level of syntax, this extension involves adding corresponding operators to the syntax in Definition 1. Semantically, it involves a new definition of worlds (Definition 3) that capture agents' evidence, and incorporating propositional discourse referents into the model of states (Definition 5). This model of propositional discourse referents comes from Starr (2018) — who draws on Kaufmann (2000), Stone (1999), Bittner (2007) and Murray (2014, 2010).

Definition 1 (DLME Syntax)

(1)	$\alpha \in \mathscr{R}ad$	if $\alpha \in At = \{A, B, C, D, \ldots\}$
(2)	$\neg\rho \in \mathscr{R}ad$	if $\rho \in \mathscr{R}ad$
(3)	$(\rho_1 \wedge \rho_2) \in \mathscr{R}ad$	if $\rho_1, \rho_2 \in \mathscr{R}ad$
(6)	$\triangleright\rho \in \mathscr{S}ent$	if $\rho \in \mathscr{R}ad$
(7)	$!\rho \in \mathscr{S}ent$	if $\rho \in \mathscr{R}ad$
(8)	$?\rho \in \mathscr{S}ent$	if $\rho \in \mathscr{R}ad$
(9)	$\triangleright_d \rho \in \mathscr{S}ent$	if $\rho \in \mathscr{R}ad$
(10)	$\triangleright_r \rho \in \mathscr{S}ent$	if $\rho \in \mathscr{R}ad$
(11)	$(\phi \wedge \psi) \in \mathscr{S}ent$	if $\phi, \psi \in \mathscr{S}ent$

Remark 2 This syntax prevents negation from scoping over mood, or evidentials, and it prevents one mood from scoping over another. But, crucially, it does not prevent mood or evidentials from scoping under conjunction. These constraints are a crude approximation of the syntax of mood and evidentiality in natural language. The syntax also makes it impossible to combine evidentials with non-declarative moods. This is a simplification for our purposes here, since evidentials do occur with non-declarative moods (see §3.3).

Definition 2 (Agents) A non-empty set of **agents** $A = \{x_0, \ldots, x_n\}$

Remark 3 As DLME is propositional, it does not have a general mechanism for talking about individuals. However, evidentials involve individuals who have evidence. We call these individuals the agents, and Definition 2 requires them to be non-empty.

Definition 3 (Possible Worlds)

1. V is the set of atomic valuations; each assigns every atomic radical to one truth-value
   - $V: At \mapsto \{0, 1\}$
2. E is the set of evidential states; assigns each agent in A to a body of direct and reportative evidence
   - $E: A \mapsto (\mathscr{P}(V) \times \mathscr{P}(V))$
   - For $e \in E$ and $x_i \in A$, $e(x_i) = \langle p_d, p_r \rangle$ where p_d and p_r are sets of atomic valuations modeling x_i's direct evidence (p_d) and reportative evidence (p_r)
3. W is the set of possible worlds, each $w \in W$ is an atomic valuation and an evidential state: $w = \langle v_w, e_w \rangle$.
   - $W: V \times E$
4. Useful notation, where $w = \langle v_w, e_w \rangle \in W$:
   a. When $\alpha \in At$: $w(\alpha) := v_w(\alpha)$
   b. When $p \subseteq V$: $ex(p) := \{\langle v, e \rangle \mid v \in p \ \& \ e \in E\}$
   c. When $x_i \in A$ and $e_w(x_i) = \langle p_d, p_r \rangle$:
      - $DE(x_i, w) := ex(p_d)$ (x_i's direct evidence in w)
      - $RE(x_i, w) := ex(p_r)$ (x_i's reportative evidence in w)

Remark 4 In update semantics, it is common to identify possible worlds with atomic valuations (Veltman 1996), rather than treating them as primitive points in the model as is common in modal logic (Kripke 1959). In both cases, however, possible worlds are thought of as determining the truth of all atomic sentences. Definition 3.2 extends the treatment of worlds in update semantics to capture evidentiality using *evidential states*. A possible world consists both of an atomic valuation and an evidential state. Intuitively, the idea is that the truth value of the atomic sentences does not settle which agents have which evidence. To settle this matter, a world must also determine, for each agent x in the set of agents from Definition 2, a body of direct evidence p_d and a body of reportative evidence p_r (richer evidential systems would require a richer model of worlds here). This evidence is modeled in terms of sets of atomic valuations, rather than sets of worlds, since the latter could induce a problematic circularity in the definition of worlds. However, since it will later be useful to talk about these bodies of evidence as sets of worlds, we define the notation in Definition 3.4b, which extends a set of atomic valuations p into a set of worlds $ex(p)$ by just pairing each atomic valuation

in p with each possible evidential state e. This creates a proposition which takes no stand on who has what evidence, but takes the same stand on what atomic propositions are true as p. Definition 3.4c uses this idea to represent an agent's direct and reportative evidence in a world as a proposition.

Definition 4 (Preference Relations)

1. A **preference relation** R is a relation on propositions
   - W is the set of possible worlds; each assigns every atomic radical to one truth-value
     - $W : At \mapsto \{0, 1\}$
   - $R : \mathscr{P}(W) \times \mathscr{P}(W)$
2. R's **context set** c_R is the union of propositions ranked by R.
   - $c_R = \bigcup \text{field} \, r$, where $\text{field} \, R = \text{dom} \, R \cup \text{ran} \, R$
3. R's **alternatives** Alt_R is the propositions related by R.
   - $Alt_R = \text{field} \, R$, where $\text{field} \, R = \text{dom} \, R \cup \text{ran} \, R$
4. R's **question set** Q_R is the set of partitions of c_R, which are alternatives and ranked over the empty set.
   - $Q_R = \{\{p, q\} \mid \langle p, \varnothing \rangle \in R \,\&\, \langle q, \varnothing \rangle \in R \,\&\, p \cup q = c_R \,\&\, p \cap q = \varnothing\}$

Definition 5 (States) A *state* $S = \langle R_S, d_S, i_S \rangle$ is a triple consisting of:

1. A preference relation R_S
2. An n-tuple of propositions $d_S = \langle p_i, \ldots, p_j, c_{r_s} \rangle \in \mathscr{P}(W)^n$ (where $n \geqslant 1$)
   - d_S is the list of propositional discourse referents.
   - d_S always contains c_{R_S} as its last element; there is always a propositional discourse referent for c_{R_S}.
   - When $n = 1$, $d_S = \langle c_{R_S} \rangle$.
3. A speaker $i_S \in A$

Remark 5 It is important to highlight that this definition of a state includes the speaker (i_S). We abstracted from this detail in the presentation in §3, but it is essential for capturing the way in which evidentials get anchored to an individual (the speaker in declaratives). Because DLME is propositional, it doesn't have a general capacity to talk about individuals. With a richer representation language, such as Murray (2014), the speaker would not have to be a separate component of a state. In our semantics for evidentials below, we use the speaker of the context to determine an evidential anchor.

Definition 6 (Initial State) For each $x_i \in A$, $\mathbf{I} := \langle \{\langle W, \varnothing \rangle\}, \langle W \rangle, x_i \rangle$

Definition 7 (Atomic Radical Semantics) For $c \subseteq W$, $\alpha \in At$: $c[\alpha] = \{w \in c \mid w(\alpha) = 1\}$

Definition 8 (Connective Semantics) $\rho, \rho_1, \rho_2 \in \mathscr{R}ad$; $\phi, \psi \in Sent$

1. $c[\rho_1 \wedge \rho_2] = (c[\rho_1])[\rho_2]$ 3. $S[\phi \wedge \psi] = (S[\phi])[\psi]$

2. $c[\neg \rho] = c - c[\rho]$

Remark 6 This semantics appears to give two meanings for conjunction, but this is easily avoided by quantifying over types of sets that can be updated (sets of worlds c or triples like S).

Definition 9 (Radical Propositions) $[\![\rho]\!] := \{w \mid \{w\}[\rho] = \{w\}\}$

Remark 7 This will be used to identify the static semantic content of a radical that is used by sentential mood operators to update states.

Definition 10 (Imperative Semantics)
$S[!\rho] = \langle R_S \cup \{\langle c_{R_S}[\rho], c_{R_S} - c_{R_S}[\rho] \rangle\}, \rho \circ d_S, i_S \rangle$

- $\rho \circ d_S := \langle [\![\rho]\!], p_n, \ldots, p_1, c_{R_S^*} \rangle \in \mathscr{P}(W)^{n+2}$ where $d_S = \langle p_n, \ldots p_1, c_{R_S^*} \rangle \in \mathscr{P}(W)^n$ and $n \geqslant 1$.
- $R_S^* := R_S \cup \{\langle c_{R_S}[\rho], c_{R_S} - c_{R_S}[\rho] \rangle\}$

Remark 8 Imperatives add a preference for their radical over its negation to all incoming information, questions and preferences. They also add that radical's content to the front of d_S. Even though it has not been used to eliminate worlds from the context set, it is a propositions the agents are attending to. Subsequent modals can anaphorically retrieve this set of worlds (Starr 2018). Note that the new context set $c_{R_S^*}$ is appended to the end of d_S, so it always counts as one of the propositions being attended to.

Definition 11 (Interrogative Semantics)

$S[?\rho] = \langle R_S \cup \{\langle c_{R_S}[\rho], \varnothing\rangle, \langle c_{R_S} - c_{R_S}[\rho], \varnothing\rangle\}, \rho \circ d_S, i_S\rangle$
- $\rho \circ d_S := \langle[\![\rho]\!], p_n, \ldots, p_1, c_{R_S^*}\rangle \in \mathscr{P}(W)^{n+2}$ where $d_S = \langle p_n, \ldots p_1\rangle \in \mathscr{P}(W)^n$ and $n \geqslant 1$.
- $R_S^* := R_S \cup \{\langle c_{R_S}[\rho], \varnothing\rangle, \langle c_{R_S} - c_{R_S}[\rho], \varnothing\rangle\}$

Remark 9 Polar interrogatives raise a question by adding a preference for each of its answers over the empty set on top of all incoming information, questions and preferences. Further, the answer that corresponds to the sentence form is added to the front of d_S, making it available for anaphora in responses like *Yes*, even though it has not been used to eliminate worlds from the context set. Note that the new context set $c_{R_S^*}$ is appended to the end of d_S, so it always counts as one of the propositions being attended to.

Definition 12 (Declarative Semantics)

$S[\rhd\rho] = \langle R_S + \rho, \rho \circ d_S, i_S\rangle.$
- $R_S + \rho = \{\langle a[\rho], a'[\rho]\rangle \mid \langle a, a'\rangle \in R_S \ \& \ a[\rho] \neq \varnothing\}$
- $\rho \circ d_S := \langle[\![\rho]\!], p_n, \ldots, p_1, c_{R_S^*}\rangle \in \mathscr{P}(W)^{n+2}$ where $d_S = \langle p_n, \ldots p_1\rangle \in \mathscr{P}(W)^n$ and $n \geqslant 1$.
- $R_S^* := R_S + \rho$

Remark 10 Declaratives use the radical to eliminate worlds incompatible with them from each alternative. This can have substantive consequences for the preferences and questions in the output state. Further, the content of the radical is added to the front of d_S, in exactly the way it is for imperatives and interrogatives. Note that the new context set $c_{R_S^*}$ is appended to the end of d_S, so it always counts as one of the propositions being attended to.

Definition 13 (Direct Declarative Semantics)

$S[\rhd_d\rho] = \langle R_S \oplus_d \rho, \rho \circ d_S, i_S\rangle$, where:
- $R_S \oplus_d \rho := \{\langle a[\rho] \cap DE(i_S, \rho), a'[\rho] \cap DE(i_S, \rho)\rangle \mid \langle a, a'\rangle \in R_S \ \& \ a[\rho] \cap DE(i_S, \rho) \neq \varnothing\}$
- $DE(i_S, \rho) := \{w \mid DE(i_S, w)[\rho] = DE(i_S, w)\}$
  - $DE(i_S, \rho)$ is the set of worlds where i_S's direct evidence supports ρ
- $\rho \circ d_S := \langle[\![\rho]\!], p_n, \ldots, p_1, c_{R_S^*}\rangle \in \mathscr{P}(W)^{n+2}$ where $d_S = \langle p_n, \ldots p_1\rangle \in \mathscr{P}(W)^n$ and $n \geqslant 1$.
- $R_S^* := R_S \oplus_d \rho$

Remark 11 This semantics is a slight variant on the declarative semantics. The same proposition is made at-issue $[\![\rho]\!]$ by adding it to the front of d_S, and those worlds are also eliminated from the context set. This is the 'scope proposition'. But one also eliminates another set of worlds from the context set without adding it to d_S, namely the evidential proposition. This is defined as the set of worlds $DE(i_S, \rho)$ where the speaker's direct evidence already included any information that ρ could provide ($DE(i_S, w)[\rho] = DE(i_S, w)$). Here, the speaker's direct evidence is treated as a context set for update with the radical ρ. This set of worlds, $DE(i_S, \rho)$, gives the content of the non-at-issue content of a declarative with a direct evidential. As before the new context set $c_{R_S^*}$ is appended to the end of d_S, so it always counts as one of the propositions being attended to. It is worth noting that the contributions of sentential mood and the evidential are separable here, even though they are fused into one operator. The direct evidential is simply augmenting the content being added to the context set by the declarative, without changing the content of the at-issue content. In a suitably rich system, these two different effects could be separated to arrive at a fully compositional analysis (Murray 2014).

Definition 14 (Reportative Declarative Semantics)

$S[\rhd_r\rho] = \langle R_S \oplus_r \rho, \rho \circ d_S, i_S\rangle$, where:
- $R_S \oplus_r (\rho) := \{\langle a \cap RE(i_S, \rho), a' \cap RE(i_S, \rho)\rangle \mid \langle a, a'\rangle \in R_S \ \& \ a \cap RE(i_S, \rho) \neq \varnothing\}$
- $RE(i_S, \rho) := \{w \mid RE(i_S, w)[\rho] = RE(i_S, w)\}$
  - $RE(i_S, \rho)$ is the set of worlds where i_S's reportative evidence supports ρ
- $\rho \circ d_S := \langle[\![\rho]\!], p_n, \ldots, p_1, c_{R_S^*}\rangle \in \mathscr{P}(W)^{n+2}$ where $d_S = \langle p_n, \ldots p_1\rangle \in \mathscr{P}(W)^n$ and $n \geqslant 1$.
- $R_S^* := R_S \oplus_r \rho$

Remark 12 This semantics is also a variant on the declarative semantics. The same proposition is made at-issue $[\![\rho]\!]$ by adding it to the front of d_S. This is the 'scope proposition'. Like direct evidentials, reportatives add their evidential proposition to the context set update, but they also eliminate or trivialize the context set update with the scope proposition — note that $\neg\rho$-worlds do not get eliminated from the context set here. This explains why reportatives can be felicitously denied while still making only their scope proposition at-issue. Again, the contributions of sentential mood and the evidential are separable here, even though they are fused into one operator. The reportative evidential changes the content being added to the context set by the declarative, without changing the content of the at-issue content.

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