On the relation between verbal mood and sentence mood

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1   Overview

The goal of this paper is to contribute to a better understanding of the relation between two categories associated with the term "mood" in the linguistics literature. These two categories are **verbal mood**, the category most obviously including indicative and subjunctive, and **sentence mood**, the one which includes declarative, interrogative, and imperative. Verbal mood and sentence mood are certainly not the same — the first is a traditionally understood as a morphological cateogry, the second as a pragmatic one — but they are closely linked. For example, among languages that make a distinction between indicative and non-indicative verbal moods, declarative sentences typically have to be indicative. In contrast, imperatives are typically not indicative in such languages, and in fact imperative verbs are sometimes classified (within a particular language where this makes sense) as having a separate verbal mood of their own. In such a language, imperative verbal mood marks imperative sentence mood. These points indicate that there is something about either the structure or the semantics of the verbal moods which is relevant to the conversational functions associated with the sentence moods.

One can think of various routes towards explaining these types of connections. We might take a syntactic approach, according to which non-indicative is a marker of subordination, and so a non-indicative clause which looks like a root sentence would have to really be embedded within some unpronounced structure. This way of thinking would fit well with Kaufmann's (2012) theory of imperatives, for example. I will argue for a different approach, however, one based on semantics. The argument will proceed through four steps: I will first review some connections between verbal mood and sentence mood. These connections are well-known, but have only rarely been discussed in connection with semantic and pragmatic

theories of mood. Second, I will identify and formalize some striking similarities between theories of verbal mood and sentence mood; doing this will allow us to see what the implicit "state of the art" in linguistic theory has to say about the relation between them. Though this state of the art has is in some ways quite revealing, it leads directly to the third step: identifying a problem which afflicts our understanding of the parallels between verbal mood and sentence mood, and therefore of these basic categories of mood themselves. The fourth part of the paper aims to outline some new ideas about mood which can solve this problem.

According to the implicit state of the art, verbal mood and sentence mood are related because, at an abstract level, thought and conversation are encoded in grammar in the closely related ways. In practical terms, this means that the semantics of attitude verbs like *believe* and *want* can be analyzed using the same abstract framework of modal semantics as the discourse functions of declaratives and imperatives. According to this view, verbal mood and sentence mood are related because they are defined in terms of the same basic framework of modal semantics. More specifically, there are close parallels in the "external semantics" (contibution to the meaning of larger units which include it) of two groups of moods, crosscutting the verbal mood/sentence mood divide. One group (subjunctives, infinitives, and imperatives) are used to produce meanings related to **ordering** or **comparison** of possibilities, while the other (indicatives, declaratives and interrogatives) are used to produce meanings related to the categorical classification of possibilities as relevant or irrelevant.

Assuming it is correct that subjunctives and imperatives both are used to produce meanings related to ordering, what is the precise contribution of the subjunctive verbal mood or the grammatical form of an imperative that leads it to be used in this way? One idea, which many linguists and philosophers find attractive, is that the meaning simply is the fact that it is used in this way. In other words, subjunctive mood marks that a clause is being used to produce a order-based meaning in a subordinate clause, and the imperative form indicates that a clause is being used to produce an order-based meaning in discourse. Subjunctive morphology marks that the clause is embedded in a structure with the right kind of modal semantics, while imperative verbal mood is a "force marker", specifying that the sentence is used in discourse to produce the right kind of directive effect. We might call this the **function-marking theory** of the relation between verbal mood and sentence mood.

In the second half of the paper, I will argue that the function-marking theory fails to explain important similarities in the internal semantics (i.e. the compositional semantic values) of subjunctives, infinitives, and imperatives. The feature of internal semantics which is crucial to my argument concerns *de se* and related concepts ("*de te*" and "*de nunc*"). Subjunctives, infinitives, and imperatives are closely associated with *de se* interpretations of their subject and tense arguments. I will propose that we can describe them as showing *de se* "by default", as opposed to *de se* in other clause types, which is optional and requires extra structure. We face **the comparison–*de se* puzzle**.

- THE COMPARISON–*DE SE* PUZZLE: Why do comparison and *de se* by default go together?

Existing theories of verbal mood and sentence mood have nothing to say about the puzzle, and for this reason it has important implications for our understanding of these topics.

In the final section of the paper, I will propose a theory to explain both the connections between verbal mood and sentence mood and the comparison-*de se* puzzle. I will propose a framework for understanding the relation between verbal mood and sentence mood. The main hypotheses of this framework are as follows:

1. The denotations of mood categories (both verbal mood and sentence mood) are distinguished along two dimensions: SATURATION and PARTITIONHOOD.

   - **Saturation**: a full clausal semantics can be derived in which the subject and temporal arguments of a predicate are either saturated or unsaturated.
   - **Partitionhood**: a full clausal semantics can be either a proposition or a partition.[1]

2. The most basic clausal semantics is a fully unsaturated proposition, modelled here as a set of individual-time-world triples (in the standard terminology, a individual-time centered proposition).

3. There are semantic operations which can saturate the subject and/or tense argument, and which can form a partition from a proposition, and these operations are associated with material in the inflectional system. We will assume that morphemes in the IP and CP domains can have saturation and partitioning operators as their semantic values.

4. All languages can perform both the partitioning and saturation operations. The simplest mood system bundles the operators into a single morpheme, resulting in a main two-way distinction:

   - In sentence mood: declarative/interrogative and imperative.
   - In verbal mood: indicative and non-indicative.

5. Declaratives and interrogatives differ not in their semantic type (both denote partitions), but rather in whether the partition is trivial (a single equivalence class, for declaratives) or non-trivial (multiple equivalence classes, for interrogatives). This difference is due to the semantic contribution of question words or wh-features.[2]

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[1]The partition semantics framework of Aloni and van Rooy (2002) and Aloni et al. (2007) is convenient for developing these ideas, but they could be cast in terms of other ideas about the higher-type denotation used for making assertions and asking questions, for example the propositions of inquisitive semantics (Ciardelli et al., 2013).

[2]Lohnstein (2007) proposes a very similar analysis of the relation between declaratives and interrogatives.

6. Languages may make further mood distinctions by separating the partioning and saturation operations.

While the properties of mood systems are derived within the syntax/semantics interface in the way outlined above, they are also motivated by the need for the grammatical system to serve the essential functions of conversation in the following way:

7. Saturation determines whether the pragmatic function of a clause is to update of an individual's discourse commitments (the commitment slate) or mutual discourse commitments (e.g. the common ground).[3]

8. Partitionhood determines whether the pragmatic function of a clause is to target the information-related side of discourse (the common ground and questions under discussion) or the "prioritizing" or planning side of discourse (the to-do list).

It should be apparent that the goals of this paper are quite broad, and I must conclude by acknowledging what is missing. In order to see the connections between verbal mood and sentence mood, we have to focus on the essential, core properties of both, and set aside all manner of language-internal complexity and crosslinguistic variation (see Portner, to appear, for a detailed overview). Doing this requires us to decide which properties are the essential, core ones, and yet how are we to know which properties these are? I assume that the right answer to this question is: by looking at the best current theories. From this choice I will conclude, for example, that the essential property of the subjunctive is that it is used as the argument of predicates which express meanings based on modal comparison. Of course, not all facts about the subjunctive can be neatly explained in terms of this simple idea (and I will list some of them below), and likewise not all that is known about other verbal moods and sentence moods can be explained within the theory which I propose. It is my hope and expectation that this theory can then be extended and improved to cover more of verbal mood, and more of sentence mood, in a way which continues to capture the relation between them. Even if this expectation is not met, though, this project may at least establish it as an important criteria for evaluating theories of mood that they help us understand the relation, because our theories of each type of mood are now advanced enough that we should expect them to say something about it.

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[3]As will be explained further below, this idea comes from the work of Wechsler and Coppock (2016); Coppock and Wechsler (submitted).

2 Patterns of connection between verbal mood and sentence mood

It is well known that there are many connections between verbal mood and sentence mood at the morphosyntactic and semantic levels. In this section, I will illustrate the types of connections which I wish to explain. In order to do this in a clear way, we need to begin with some definitions (from Portner, to appear):

- MOOD is an aspect of linguistic form which indicates how a semantic content is used in the expression of modal meaning.

    - VERBAL MOOD indicates how a clause is used in the computation of modal meaning within the compositional semantics of phrases that contain it (subsentential modality).
    - SENTENCE MOOD indicates how a clause is used to perform fundamental conversational functions within semantic/pragmatic theory (discourse modality).

It is a theory-dependent question what these "fundamental functions" which define the sentence moods are, but we have a name for them: the SENTENTIAL FORCES. The main theories we need to look at to try to understand the nature of sentential force, and then of sentence mood, are classical speech act theory and dynamic semantics and pragmatics.[4]

It is also important to distinguish sentence mood from the closely related category of clause type:

- CLAUSE TYPES are grammatically defined classes of sentences which correspond closely to sentence moods.

The fact that clause type and sentence mood are different concepts can be seen by considering the embedded interrogative in (1):

(1) Mi chiedo   se ci   siano   corsi   d'inglese. (Italian)
     me wonder-1sg if there be.3PL.SUBJ courses of English

     'I wonder whether there are English courses.'

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[4]Relevant work within speech act theory includes Katz and Postal 1964; Sadock 1974; Searle 1975; Bach and Harnish 1979; Searle and Vanderveken 1985; Vanderveken 1990, 1991; Zaefferer 2007; Charlow 2011; Rett 2011; Kaufmann 2012; Krifka 2014. Relevant work within the dynamic approach includes Hamblin 1971; Gazdar 1979; Groenendijk and Stokhof 1990, 1991; Groenendijk et al. 1997; Aloni et al. 2007; Aloni and van Rooy 2002; Portner 2004; Groenendijk and Roelofsen 2009; Farkas and Bruce 2010; Roberts 2012; Starr 2013.

The complement clause in (1) is of the interrogative clause type, but the fact that it is subjunctive means that it cannot be used as a root sentence to ask a question. So, according to the linguists' traditional use of the notion, it does not have interrogative sentence mood.

Now we turn to the ways in which the categories of verbal mood and sentence mood are linked. In this paper, we will restrict our attention to languages which make the "Standard Average Western European"[5] distinction between indicative and subjunctive. Example (2) illustrates the obvious connection between indicatives, on the one hand, and declaratives and interrogatives, on the other.

- The declarative and interrogative sentence moods require indicative verbal mood.

    1. Root sentences of the declarative clause type have declarative sentence mood only when their verbal mood is indicative.

    2. Root sentences of the interrogative clause type have interrogative sentence mood only when their verbal mood is indicative.

        (2) a. She smiled. (indicative verbal mood; declarative sentence mood)

             b. Did she smile? (indicative verbal mood; interrogative sentence mood)

As we will see, root subjunctive clauses are interpreted quite differently.

Imperatives are closely related to infinitives and subjunctives, but in a more complex way than the relation between indicatives and declaratives/interrogatives. The first point is that directive predicates embed infinitives and subjunctives, and imperatives to the extent that a given language allows:

(3) a. Mother told Inho **to study**.

     b. Il exige   que tu **partes**   maintenant.
        he demand that you leave.SUBJ now

        'He demands that you leave now.' (French, Mulder 2010)

     c. Emma-ka   Inho-eykey kongpuha-**la**-ko   hasiess-ta.
        mother-NOM Inho-DAT   study-IMP-COMP said(HON)-DEC

        'Mother told Inho to study.' (Korean)

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[5]I use this term loosely to indicate that our goal will be to understand the patterns of verbal mood selection which are most stable across the well-studied Romance and Germanic languages of Western and Central Europe. Haspelmath (2001) does not consider the indicative/subjective distinction to be a feature of Standard Average European. See Thieroff and Rothstein (2010) for an informative survey of mood in European languages and Portner (to appear) for a more general discussion.

In other words, infinitives, subjunctives, and imperatives are used to report the kinds of speech acts which imperatives perform. Of course, infinitives and subjunctives are used with non-directive predicates as well, but as we will see, for the most part these predicates have something in common with directives.

The next point is that in syntactic context in which the canonical imperative form is not allowed, infinitival and subjunctive verb forms are often used. For example, in Spanish the canonical imperative cannot be negated, and a verb form with subjunctive morphology is used instead:

(4)   a. **Lée**   lo!
       read.IMP it

       'Read it!' (Spanish, Han 1998)

   b. No lo **leas**!
       neg it read-2SG.SUBJ

       'Don't read it!'

In Italian, we see both subjunctives and infinitives expressing imperative sentence mood. The negative imperative has the form of an infinitive, while the polite imperative has subjunctive verbal mood.

(5)   a. **Siediti**!
       Sit.IMP-you

       'Sit!' (Italian)

   b. Non **sedersi**!
       neg sit-INF-you

       'Don't sit!'

   c. Si **sieda**!
       self sit.SUBJ.2P

       'Have a seat!' (polite)

The root subjunctives and imperatives in examples (4)-(5) are all traditionally thought of as forms of the imperative, but we also find root infinitives and subjunctives which are not standardly labeled "imperative". Even in these cases, the meaning is generally imperative-like. In (6a)-(6b), the infinitive/subjunctive is not in any obvious way triggered by a syntactic construction which disallows the imperative form, but their meaning is directive:

(6)   a. Bitte von der Bahnsteigkante **zurücktreten**.
       Please from the edge.of.the.track step.back.INF

'Please step back from the edge of the track!'
(German, Truckenbrodt 2006)

b. Que **vagin**   passant   un per un!
   that go.PRS.SUBJ.3SG come.in-GER one by one

'Let them come in one by one!' (Catalan, Quer 2010)

Pak et al. (2015) call examples like these "no-addressee imperatives" because they can be used in a context with no specific addressee (as on signs) to prescribe the actions of any individual to whom they apply. As pointed out by Palmer (2001), other nonfinite forms, like the English gerund in (7a), can have similar meanings.[6]

(7)   a. No **smoking** in the courtyard.
       b. #Smoking in the courtyard!

This association between non-finiteness and the no-addressee meaning is not universal, however. For example, Hebrew directive infinitives requires a specific addressee (Aynat Rubinstein, p.c.).

These patterns raise a number of questions:

1. Why are both interrogatives and declaratives formed using indicative verbal mood?

   - What do declaratives and interrogatives have in common?
   - How do the distinct clause type semantics of declaratives and interrogatives combine with indicative (or the subjunctive)?

2. Why are imperatives formed using non-indicative verbal moods?

   - How are imperatives crucially different from declaratives and interrogatives?
   - How are they related to infinitives and subjunctives?

My goal is to develop a framework which will allow questions like these to be answered.

3   Towards a unified theory of core mood

There are significant parallels between current theories of verbal mood and sentence mood which might provide a basis for explaining some of the connections observed in the previous

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[6]The fact that the non-negative gerund cannot have a similar meaning is presumably related to the common prohibition on combining negation with the canonical imperative form, as see in Spanish and Italian above.

section. In this section, we will observe some of these parallels, and we will make precise how the theories are related by formalizing them in a simplified way within a single logical system. I call this a unified theory of CORE MOOD. (To put the matter more precisely, core mood is the set of linguistic forms which are correctly analyzed within the same theory of mood semantics as verbal mood and sentence mood, assuming that there is such a set of forms.) It may well be that other phenomena, like evidentiality and reality status, may count as core mood or as mood in a more general sense.[7] The theory looks promising for explaining the connections between verbal mood and sentence mood outlined in Section 2, but it leads directly to the comparison-*de se* puzzle.

There are two main approaches to verbal mood in the semantics literature, what I call the **comparison-based theory** and the **truth-based theory**. The comparison-based theory develops the intuition that the subjunctive marks evaluativity, while the truth-based theory aims for a formalization of the traditional idea that indicative is a marker of "realis" meaning and the subjunctive of "irrealis". The discussion in this section will develop the comparison-based theory.[8] The key hypothesis of this approach is as follows:

- The subjunctive marks a modal semantics involving comparison between worlds.

This description of the subjunctive captures the fact that it is selected by directive predicates, noted in (3). It also accounts for the selection of subjunctive by desire predicates, causatives, and emotive factives (examples from Portner and Rubinstein 2013; Blanco 2011).[9]

(8)　a.　Pierre veut　que Marie soit　heureuse. (French)
　　　　Pierre wants that Marie is.subj happy

　　　b.　Juan hizo　que María comiera lentejas. (Spanish)
　　　　Juan made that Maria eat.subj lentils

The central idea of the comparison-based theory can be carried out in different ways. For example Giorgi and Pianesi (1997) propose that the subjunctive is selected by operators

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[7]Faller (2002) and Murray (2015) analyze evidentals as closely related to sentence mood. I use the term "reality status" in the sense of Elliott (2000) and Mauri and Sansò (2012). See Portner (to appear) for discussion.

[8]Some key references for the truth-based theory are Farkas 1992b, 2003; Giannakidou 1997, 2015; Portner 1997; Quer 2001; Schlenker 2005 and Mari 2016. As discussed by Portner (to appear), this approach is best described as proposing that mood marks whether or not the marked proposition is *true in a designated set of worlds*, where different version of the approach identify the designated set differently. Note that some research on verbal mood combines insights from the two approaches, and under certain assumptions about the semantics of modality, they may be equivalent.

[9]The selection of subjunctive by emotive factives shows crosslinguistic variation, and so we will not focus on it here. Farkas (1992b, 2003) tries to explain this variation. This analysis does not cover the reportative subjunctive, as in German (Fabricius-Hansen and Saebø, 2004), though we will return to this type of subjunctive in Section 5.

which have a non-null ordering source, while Villalta (2008) proposes that it is triggered by a semantics which compares the members of a set of alternative propositions indicated by focus. Below we will formalize this approach in a simplified way which facilitates comparison with the sentence mood.

As mentioned in Section 2, there are also two main approaches to sentence mood in the literature, what we can call the **speech act theory approach** and the **dynamic approach**. The speech act theory approach to sentence mood analyzes sentence mood as some type of marking of illocutionary force.[10] While it is often assumed that sentence mood introduces illocutionary force *per se*, through some type of "force operator", there are many different ideas within this literature concerning the relation between mood and force. For example, Bach and Harnish (1979) and Harnish (1994) derive an illocutionary force potential (a set of compatible illocutionary forces) for each sentence mood, not a specific illocutionary force. Searle and Vanderveken (1985) and Vanderveken (1990, 1991) decompose illocutionary force into sub-compondents, and propose an association between sentences mood and one of these components, illocutionary point.[11]

The dynamic approach defines sentential force as a characteristic type of context-update. The prototype of sentential force in this way of thinking is Stalnakerian assertion, the update of the common ground. The dynamic approach will therefore define declararative sentence mood as that aspect (or those aspects) of linguistic form which indicates that a clause produces an assertion-update. Within the broader dynamic approach, we can distinguish dynamic semantics theories like those of Groenendijk and Stokhof (1990, 1991); Groenendijk et al. (1997); Aloni and van Rooy (2002); Aloni et al. (2007); Groenendijk and Roelofsen (2009) and Starr (2010, 2013) from dynamic pragmatics theories like those of Hamblin (1971); Stalnaker (1974, 1978); Gazdar (1979); Portner (2004) and Roberts (2012). (The difference between dynamic semantics and pragmatics will not be too relevant here, but see Portner, to appear, for discussion.)

In what follows, we will set aside speech act theory and focus on the dynamic approach to sentence mood. Specifically, we will work with a version of dynamic pragmatics with the following claims:

- The discourse context has an abstract structure in which it represents the interlocutors'

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[10]Some basic references on the speech act theory approach to sentence mood are Katz and Postal 1964; Sadock 1974; Searle 1975; Searle and Vanderveken 1985; Vanderveken 1990, 1991; Zaefferer 2007; Charlow 2011; Rett 2011; Kaufmann 2012, and Krifka 2014.

[11]In this description of Bach and Harnish's and Searle and Vanderveken's proposals, I have both simplified greatly and imposed my senses of the terms "sentence mood" and "sentential force". See Portner (to appear) for a more careful discussion of how these scholars' work fits into the broader literature on sentence mood.

I should also note that some work classified here within the speech act theory approach, for example the proposals of Charlow (2011) and Kaufmann (2012), incorporates significant insights from the dynamic approach.

    factual commitments, open inquiries, and plans and priorities for action

- Each of the basic sentence moods characteristically updates one of the above. Specifically:

  – Declaratives update the factual commitments.

  – Interrogatives update the open inquiries.

  – Imperatives update the plans and priorities for action.

- These characteristic updates can be identified as the sentential force of the sentence mood.

This basic picture is common to most work in the dynamic tradition, though there are important differences. For example, while Stalnaker treats the factual commitments as mutual (the common ground), a line of work represented by Hamblin (1971), Gunlogson (2001), Farkas and Bruce (2010) and Portner (to appear) argues that we need to keep track of the individual commitments of each participant in a conversation. Moreover, theories of sentence mood are often not very clear on the precise role of grammatical form in conversational update. For example, work in philosophy often assumes an abstract force-content logical form $F(c)$, without worrying about the grammatical features which lead to postulating a specific F in a particular case. Our goal here, though, involves understanding the precise relation between verbal mood and sentential force.

3.1   The PPOSW framework

Our investigation of the relation between verbal mood and sentence mood will proceed by casting the theories of both witin a single, simplified framework. The basic formal construct of this framework is the partitioned, partially-ordered set of worlds, or PPOSW.[12,13]

- A partitioned, partially ordered set of worlds PPOSW is a pair $s = \langle p_s, <_s \rangle$, where:

  1. p_s is a partition of a set of worlds c_s, and

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[12]The logical framework used here builds on Veltman (1996), van der Torre and Tan (1998), and Aloni and van Rooy (2002). As mentioned above, it would be possible to produce the same analysis on the assumption that interrogatives denote inquisitive propositions (Ciardelli et al., 2013), rather than partitions.

[13]Starr's (2010; 2013) model of the discourse context is rather similar in its formal structure, and aims to capture some of the same intuitions about sentence mood. One particularly elegant idea in his work is that we can embed information about the common ground within the preference state. However, there are important differences between our approaches as well, mostly arising from my goal of understanding the relation between verbal and sentence mood and the hypothesis that the semantic and discourse functions of a clause are determined by its semantic properties.

    2. $<_s$ is a pre-order over c_s.

The PPOSW will be used to model both the lexical semantics of verbs which select indicatives and subjunctives and the contextual updates associated with declaratives, interrogatives, and imperatives. Note that, formally speaking, the partition is represented as a binary relation which holds between w and v iff w and v are in the same cell of the partition, rather than as a set of subsets of c_s (Groenendijk and Stokhof 1984).

    Next we describe our logic's semantics:

- Sentences come in two types:

    1. Some denote a partition of a subset of W.
    2. Others denote a subset of W.

- We have two update functions:

    1. **Reduce** the partition: for any PPOSW s and sentence ϕ which denotes a set of pairs of worlds,
    $$s \oplus \phi = \langle p_s \cap [\![\phi]\!]^s, <_s \rangle.$$
        (a) When $s \oplus \phi$ shrinks c_s (the domain of p_s), we call it an **assertive update**.
        (b) When $s \oplus \phi$ subdivides the cells of p_s, we call it an **inquisitive update**.
    2. **Refine** the order:[14] for any PPOSW s and sentence ϕ which denotes a set of worlds,
    $$s \star \phi = \langle p_s, <_s \circ [\![\phi]\!]^s \rangle.$$

Note that only one update function is defined for any given sentence: if ϕ denotes a partition, its update is $\oplus$, but if it denotes a set of worlds, its update is $\star$. Therefore, we could define a general update operation $s + \phi$, which performs the type-appropriate update $s \oplus \phi$ or $s \star \phi$.

    When ϕ denotes a partition, the relation between $[\![\phi]\!]^s$ and s determines whether the update is assertive or inquistive. However, if the partition is trivial in the sense being a single equivalence class, it will never result in an inquisitive update. Suppose that $[\![\phi]\!]^s = p \times p$, for some set of worlds p. Then $s \oplus [\![\phi]\!]^s$ will always be assertive (if it has any effect at all). We call such a partition PROPOSITIONAL. In contrast, if $[\![\phi]\!]^s$ is a non-trivial partition, $s \oplus [\![\phi]\!]^s$ might produce an inquisitive update. We call such a partition INTERROGATIVE or a QUESTION.

    It will also be useful to define two dynamic-semantics style modals:

- The basic necessity modals for a PPOSW s are:

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[14]Veltman (1996): $<_s \circ p = \{\langle w, v \rangle : \ w <_s v \text{ and if } v \in p, \text{ then } w \in p\}$

1. **Informational modal**: $[[\ \Box_c \phi \ ]]^s = 1$ iff $c_s \subseteq [[\ \phi \ ]]^s$
2. **Preference modal**: $[[\ \Box_< \phi \ ]]^s = 1$ iff $\mathbf{max}_s \subseteq [[\ \phi \ ]]^s$

Note that the modals can only apply to ϕ which denotes a set of worlds. If we think of c_s and $<_s$ as a modal base and ordering source, $\Box_c \phi$ expresses simple necessity and $\Box_< \phi$ expreses human necessity (Kratzer 1981).

Now we will turn to applying the PPOSW framework to verbal mood and sentence mood. In this section, my intent is to formalize the key ideas of some existing theories of mood within this one formal system. This formalization certainly simplifies both the phenomena and the theories, but it is useful because it allows us to observe more clearly how the theories are related to one another. Once we see these relations, we will be able to undertake building better theories of verbal mood, sentence mood, and the connections between them.

3.2 The PPOSW framework applied to verbal mood

The PPOSW framework allows us to express the key insights of the comparison-based theory of verbal mood. For this purpose, the PPOSW models an individual's cognitive state:

- An agent a's **cognitive model** in situation e is a PPOSW $m(a, e)$ where:

  1. $c_{m(a,e)} =$ the set of worlds compatible with a's beliefs in e; and
  2. $<_{m(a,e)} =$ the ordering of worlds which represents a's desires in e.

We give the semantics of 'believe' and 'want' in terms of the cognitive model.[15]

(9) $[[\ A \ believe \ that \ \phi \ ]]^s = \{w : \exists e_w [[[\ \Box_c \phi \ ]]^{m(a,e)} = 1]\}$

(10) $[[\ A \ want \ \phi \ ]]^s = \{w : \exists e_w [[[\ \Box_< \phi \ ]]^{m(a,e)} = 1]\}$

An agent a believes ϕ in w iff there is a situation e in w such that a's beliefs in e entail ϕ. This is the standard analysis of belief as doxastic necessity. Similarly, a wants ϕ in w iff there is a situation e in w where the most-desired doxastically accessible worlds are all ϕ worlds.

According to the comparison-based theory of verbal mood, 'want' selects the subjunctive because its meaning makes use of comparison among worlds, as represented by the ordering $<_{m(a,e)}$. 'Believe' selects the indicative because its meaning only cares about the domain $c_{m(a,e)}$, not about the ordering. We can summarize this idea with the following principles:

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[15]The notation of single quotes indicates the counterpart of this English word in whatever language or languages we are talking about. Hence, a statement about 'want' here is about the counterpart of *want* in any language in which it selects the subjunctive.

- **Indicative principle**: If a clause ϕ is operated on by the informational modal, its form is indicative.

- **Subjunctive principle**: If a clause ϕ is operated on by the preference modal, its form is subjunctive.

In order to incorporate other verbs into the analysis, the PPOSW structure will need to be enriched, both with additional background sets or partitions, analogous to the belief-set $c_{m(a,e)}$, and additional orderings, parallel to $<_{m(a,e)}$.

It is important to notice that the definition of the cognitive model given above tells us nothing about the partition-structure $p_{m(a,e,)}$ of the PPOSW other than its domain $c_{m(a,e)}$. It only tells us that the domain is the set of worlds compatible with a's beliefs in e. The partition structure of $p_{m(a,e,)}$ would represent the issues that the agent wonders about or is interested in; on the linguistic side, the partition would be part of the semantic analysis of verbs which embed interrogatives. Perhaps surprisingly, there are no explicit theories of verbal mood in interrogatives (as far as I know). Since our goal here is to formalize the key insights of existing theories of verbal mood, we cannot put that partition structure to use, and this is why it is ignored in the definition of cognitive model. We certainly do need a theory of verbal mood in interrogatives, though, as shown by the contrast in (11)-(12):

(11) Gli avevo chiesto se ci sono corsi d'inglese.
him have-1sg asked if there be.3PL.INDIC courses of English

'I asked him whether there are English courses.' (Italian; Zanuttini, p.c.)

(12) Mi chiedo se ci siano corsi d'inglese.
me wonder-1sg if there be.3PL.SUBJ courses of English

'I wonder whether there are English courses.'

Here we see that Italian *chiedere* takes the indicative when it means 'ask' but the subjunctive when it means 'wonder'. Intuitively, this is because 'wonder' means something like 'want to know', where 'want' triggers subjunctive. I will speculate about the analysis of subjunctive interrogatives in Section 5.

The theory of verbal mood sketched here has been kept extremely simple so as to facilitate comparison with the theory of sentence mood, but it is important to acknowedge some of the problems which face this kind of comparison-based theory. We have to worry about the following, among many other empirical issues:

1. Cross-linguistic variation in mood selection.

2. Contextual variation in mood selection with a single predicate (Smirnova, 2012; Mari, 2016)

3. Predicates which are intuitively comparative but take indicative: 'hope', 'promise', 'probable' (Portner and Rubinstein, 2013)

4. Predicates which are intuitively non-comparative but take subjunctive: 'possible', 'necessary' (Portner and Rubinstein, 2013)

5. Polarity subjunctives, i.e. subjunctives triggered by negation and other operators (Portner, 1997; Quer, 1998; Giannakidou, 2011)

See Portner (to appear) for detailed discussion of these and other issues with existing theories of verbal mood.

3.3 The PPOSW framework applied to sentence mood

The PPOSW framework allows us to capture important ideas in the dynamic approach to sentence mood. Here we use the PPOSW to model the discourse context:

- A discourse context D is a PPOSW, where:

    1. p_D represents the common ground and questions under discussion, and
    2. $<_D$ represents addressee's to-do list.

The partition p_D carries the information which the well-known framework of Roberts (2012) splits between the common ground and the question under discussion set. Each cell of p_D corresonds to one complete, exact answer to all of the open questions in the conversation, while the domain of the partition c_D is the context set (the intersection of the common ground). This definition is far too simple to be a complete analysis of convesation, of course, and in the next section we will be forced to consider more sophisticated alternatives. However, this simplicity is helpful for purposes of bringing out the relation between verbal mood and sentence mood.

I assume that some root sentences denote partitions while others denote simple sets of worlds. Specifically, each of the major sentence moods has a distinct semantic type:

1. Root declaratives denote propositional partitions.

2. Root interrogatives denote interrogative partitions.

3. Imperatives denote sets of worlds.

Given this range of meanings for root sentences, the framework tells us the specific update which a sentence ϕ in discourse context D performs:

1. **Reducing updates**. If ϕ is a set of pairs of worlds, update D to $D \oplus \phi$:

   (a) **Assertion**: Perform an assertive update of D to $D \oplus \phi$.

   (b) **Asking**: Perform an inquisitive update of D to $D \oplus \phi$.

2. **Refining** update. If ϕ is a set of worlds:

   - **Directing**: Update D to $D \star \phi$.

From this, we can identify the sentential forces of the basic sentence moods:

1. **Declaratives**: The sentential force of a declarative sentence is assertion.

2. **Interrogatives**: The sentential force of an interrogative sentence is asking.

3. **Imperatives**: The sentential force of an imperative sentence is directing.

This analysis fits with the "compositional approach to sentence mood", that is the idea that sentential force is not encoded *per se* in syntax, but rather derived from the semantic properties of a sentence using general pragmatic principles of discourse interpretation. (Hausser, 1980; Huntley, 1984; Pendlebury, 1986; Wilson and Sperber, 1988; Portner, 2004, to appear; Lohnstein, 2007; Roberts, to appear). In this system, there is no need for force to be grammatically encoded, since it follows directly from semantic type and the range of possible updates within the PPOSW framework.

3.4 The relation between verbal mood and sentence mood in the PPOSW framework

These sketches of analyses of verbal mood and sentence mood within the PPOSW framework show how very similar the theories of these two types of mood are. This degree of similarity motivates the idea that verbal mood and sentence mood have something in common, that is that they comprise a broader category of core mood. Moreover, at a general level, the analyses give some insight into why subjunctive verbal mood is related to imperatives. Subjunctives and imperatives both relate to the ordering of a PPOSW, either the ordering component of the cognitive model, in the case of subjunctives, or the preference ordering of the discourse context, in the case of imperatives. The relation between indicative verbal mood, on the one hand, and declarative and interrogative sentence moods, on the other, remains somewhat more unclear. They share the fact that they relate only to the partition component of the PPOSW, not the ordering. This may be the beginning of an insight. But matters are complicated because we have treated embedded declaratives as denoting simple sets of worlds, but root declaratives and interrogatives as partitions.

We can streamline the relation between verbal mood and sentence mood if we change the type of embedded declaratives and treat them as propositional partitions.[16] This change is certainly feasible, since we can recover the set of worlds from a propositional partition, but we will need to recast the semantics of 'believe' so that it can combine with a clause which denotes a partition, rather than a set of worlds. These changes yield the following picture:

1. Verbal mood

   (a) Indicatives denote partitions of a set of worlds.

      i. Indicative declaratives denote propositional partitions.

      ii. Indicative interrogatives denote interrogative partitions (i.e. questions).

   (b) Subjunctives denote sets of worlds.

      i. Subjunctive declaratives denote sets of worlds.

      ii. Nobody knows much about subjunctive interrogatives

2. Sentence mood

   (a) Indicative declaratives denote propositional partitions.

   (b) Indicative interrogatives denote interrogative partitions.

   (c) Imperatives denote sets of worlds.

This theory would treat all indicatives consistently as denoting partitions, and it would capture the connection between subjunctives and imperatives by saying that both denote sets of worlds, not partitions. We would then be able to explain such properties as the imperative-like function of root subjunctives by pointing out that their semantic type (set of worlds) triggers the refining update, which amounts to directive sentential force when applied to the discourse context.

4   The comparison–*de se* puzzle

The goal of the previous section was to highlight the ideas about the relation between verbal mood and sentence mood which can be derived from a comparison of existing theories. I think that the conclusion should be that this strategy can lead to a number of important insights. Now I would like to argue, though, that something crucial is missing. There is a further connection between verbal mood and sentence mood about which theories we have reviewed so far have nothing to say. This connection has to do with the internal semantics

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[16]As mentioned above, this point in the analysis is inspired by the proposal of Lohnstein (2007), as well as by certain versions of dynamic semantics and inquisitive semantics.

of infinitives, subjunctives, and imperatives, in particular with the relation between mood and *de se* meaning.

We are used to describing the readings of nominal arguments and tense as *de se* (or one of the more specific variants, *de te* and *de nunc*). The *de se* construal is sometimes optional and sometimes obligatory. Here we are interested in one type of obligatory *de se*, what I call "*de se* by default":[17]

- If the tense and mood features of a clause are only compatible with an argument *A* of that clause receiving a *de se* interpretation, then the argument position associated with *A* is DE SE BY DEFAULT.

The following positions are *de se* by default: The subject of a control infinitive, the temporal argument of an infinitive, the temporal argument of a subjunctive selected by a comparative predicate, the null subject of an imperative, and the temporal argument of an imperative. Let's begin with the subject arguments. It is well known that the null subject of an infinitival complement of 'want' and similar predicates must be interpreted *de se* (Chierchia, 1989). This point is clearer in languages with a robust opposition between infinitives and subjunctives, since in such languages the subjunctive must be used when the subject is not *de se*. (This is the OBVIATION EFFECT; Picallo 1985 Raposo 1986, Suñer 1986, Farkas 1992a, Tsoulas 1996, Avrutin and Babyonyshev 1997, Quer 1998, Kempchinsky 2009, Schlenker 2005, 2011.) The following data from Catalan illustrates the point (Quer 2009, p. 1789):[18]

(13) a. No vull que saludis   absolutament ningú. (Catalan)
          neg want that say.hello.subj absolutely   anyone

          'I don't want for you to say hello to anyone at all.'

      b. No vull saludar   absolutament ningú.
          neg want say.hello.inf absolutely   anyone

          'I don't want to say hello to anyone at all.'

It is important to note that the point I am making concerns the subject argument of the embedded IP, not just the attitude expressed by the matrix verb. In (13b), we say that this argument is *de se* because a property is defined in terms of the subject of *saludar* (the property which *x* has if *x* says hello to someone), and the matrix predicate 'want' self-ascribes this property to the subject. In (13a), though the verb expresses a *de se* attitude, the self-ascribed property is not based on the subject argument of *saludar*. Rather, in this case,

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[17]*De se* by default is not quite the same thing as obligatory *de se* (Anand, 2006; Pearson, 2013), since a type of pronoun which is always *de se* (no matter the type of clause it is in) would not be *de se* by default by this definition.

[18]In English, the *for* infinitive corresponds to the subjunctive in cases like this.

the individual argument of the self-ascribed property is vacuous (the property is true of x if the addressee says hello to someone). In this case, the attitude is *de se*, but the subject argument is not *de se*.

Embedded imperatives show the same properties as infinitives. Example (14) shows a standard control infinitive, and here the speaker's utterance is true in the context where Mama is aware that her grandson is LLCJ, and false in the one where she is not. This shows that the infinitival subject is addressee-oriented *de se* ("*de te*") by default. Example (15) shows the same pattern of judgment with an embedded imperative.

(14)   [*Mama tells James that her favorite rapper LLCJ should knock out his critics. She is/isn't aware that James is LLCJ. A third party describes this as:*]
       His grandmother told him to knock them out.

(15)   [*Mama tells James that her favorite rapper LLCJ should knock out his critics. She is/isn't aware that James is LLCJ. Later LLCJ addresses his critics:*]
       Mama said knock you out. (LL Cool J, 'Mama said knock you out')

Now we turn to the time arguments of embedded infnitival and subjunctive clauses. Standard theories of embedded tense propose that complement clauses are interpreted as temporal abstracts (Abusch 1988, 1997, 2004; Heim 1994; see Klecha 2016 for a recent analysis). In some cases, the unsaturated argument in the abstract corresponds to the embedded predicate's time argument, while in others it corresponds to a reference time argument introduced by tense. Infinitives exemplify the first case; in (13b), the unsaturated temporal argument is the time argument of *saludar* (von Stechow, 1995, 2004; Giannakidou, 2009). Moreover, this sentence has no other reading where the temporal abstract is based on a different time argument. Thus, the time argument of the control infinitive is an example of *de se* by default.[19]

The temporal semantics of subjunctives is less well understood, perhaps because formal semantic analyses of embedded tense have not paid attention to the important differences between indicatives and subjunctives.[20] My argument is based on the following two patterns:

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[19]I assume that the future orientation associated with 'want' is not contributed by tense or another syntactically represented temporal operator, but rather by the higher predicate. In this, I differ from most previous work, including Stowell (1982), Portner (1997), and Abusch (2004). Evidence that this is the right approaches comes from the fact that this future orientation is not associated with any particular tense features. It occurs with both imperatives and infinitives (whether root or embedded) and with tense-agreeing subjunctives selected by a directive/desiderative predicate whether their morphological tense is past or present. Future orientation also occurs with certain indicative-selecting predicates when their complement is tense-agreeing (e.g. 'hope', Klecha 2016). While I do not currently have a clear idea of how this future orientation is derived in a natural way from the lexical semantics of the predicates, it should somehow be implied by the way the clause is used to produce an ordering relation in the PPOSW which represents the cognitive model or discourse context.

[20]There is an important literature in syntax which includes Picallo (1984, 1985), Luján (1979, 1980), Pica

First, selected subjunctives always show agreement with the matrix tense (as shown by Quer 1998, for example) and intuitively have the same temporal reference. The syntax literature says that tense is "anaphoric" to (or "bound" by) the matrix tense. And second, the temporal argument of the predicate of a clause which shows tense agreement always corresponds to the unsaturated time argument of the temporal abstract. Together, these two points imply that the temporal argument of the predicate in a selected subjunctive is *de se* by default.

Not all cases of *de se* interpretation are *de se* by default. The pronominal subject of an embedded indicative is optionally *de se*.

(16)   Mary thought that she was pregnant.

Because subject *de se* is optional here, it is not "by default". The same goes for the tense argument of an embedded indicative. As is well-known, embedded tenses can have both a "simultaneous" and a "shifted" reading. On the simultaneous reading, the temporal argument of the self-ascribed property is equivalent to the embedded predicate's time argument, while in the shifted reading, it is the reference time introduced by tense. Because both the *de se* and non-*de se* construal of the predicate's time argument are compatible with the clause's tense/mood features, the *de se* meaning is not by default.

I would like to suggest that we analyze *de se* by default and optional *de se* differently. Specifically, I propose that *de se* by default occurs when an argument position is never saturated in the course of a semantic derivation.[21] For example, the subject of a control infinitive would simply not saturate the predicate's external argument. This would lead to

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(1984), and Progovac (1993). Some exceptions in formal semantics are von Stechow (1995), Giannakidou (2011) and Schlenker (2005).

[21]There is evidence that a tense-agreeing selected subjunctive can receive a temporal *de re* interpretation when subjunctive tense is bound by an adverbial rather than the matrix tense, while the *de re* interpretation is not available in the same situation for a selecting infinitive (the idea for the scenario from Lewis 1979; data from Raffaella Zanuttini, p.c.):

[*Consider the insomniac couple. Tonight, as most nights, husband and wife lie awake for hours. While they lie awake, their states of mind change little. Each is aware that the other is also awake. All through the night they each wonder what time it is. Last night, as the husband was feeling sorry for his wife, he checked the clock and and thought he saw it was 3:49, though actually it was 5:00.*]

(i)   #Ieri notte, il   marito   voleva   essere addormentato alle   3:49.
      last night the husband want.PST be.INF asleep   at-the 3:49

      'Last night, the husband wanted to be asleep at 3:49.'

(ii) Ieri notte, il   marito   voleva   che la moglie fosse   profondamente addormentata
      last night the husband want.PST that the wife   be.PST.SUBJ profoundly   asleep
      alle   3:49 (e   che rimanesse   addormentata fino al   mattino).
      at-the 3:49 and that remain.PST.SUBJ asleep   until to.the morning

      'Last night the husband wanted the wife be in a deep sleep at 3:49 and that she remain asleep until morning.'

the infinitive denoting a property, as on Chierchia's analysis (but with a different derivation), and the grammar can derive a *de se* meaning in the way originally described by Lewis (1979). I propose that optional *de se* is produced by an additional operation, either a diagonal operator (Schlenker, 2011) or as a special case of *de re* (Maier, 2010).[22]

With this background, we can now return to the main topic, the relation between verbal mood and sentence mood. There is a correlation between *de se* by default and the external semantic functions served by infintives, subjunctive and imperatives:

- The comparison-*de se* puzzle: Why do the moods which are used to produce a modal semantics of comparison have arguments *de se* by default?

Specifically, why do imperatives, infinitives, and subjunctive, which are interpreted with respect to the order $<_s$ of a PPOSW, determine a default *de se* semantics for their subject and/or temporal arguments?

5   Semantic type, comparison, and commitment

So far I have argued that the comparison-based theory of verbal mood and the dynamic approach to sentence mood can be linked using the PPOSW framework to produce an insightful theory of the broader concept of mood — what I've called "core mood". However, this unification does not account for the similarities in internal semantics of imperatives, infinitives and subjunctives. We need an explanation for why these clauses, which have an argument intepreted as *de se* by default, are used constrain or update the ordering component of a PPOSW. In what follows I will argue that the association between *de se* and ordering is not in fact universal, but rather only a strong tendency. For this reason, I will propose that it follows not from the architecture of semantic theory, but rather from a fact about the syntax/semantics interface. Specifically, I will argue that, in the unmarked case, two types of operators (one which saturates, deriving non-*de se* meanings, and one which partitions, deriving non-order-related meanings) are linked or "bundled" as a single morpheme. These two operations are themselves motivated by the fundamental logic of modal and discourse semantics, and so are universal. But the linkage between them is a grammatical fact and subject to the principle that simple representations are preferred as a default across lan-

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This fact may suggest that subjunctive tense is a true anaphor, a variable which must be bound, in contrast to the tense of a control infinitive which corresponds to an argument of the predicate which is never saturated in the course of the semantic derivation.

[22]Anand (2006) advocates a similar approach. Park (2016) argues for a split approach to *de se* in Korean, applying the property theory to the reflexive *caki* and the *de se*-as-*de re* theory to control PRO. I am proposing the opposite here, with with the control clause denoting a property.

guages, even as more complex representations can be derived with appropriate grammatical resources.

5.1   Background: ego-marking

The approach I will propose draws some crucial insights from recent work on ego-marking in Kathmandu Newari (Wechsler and Coppock, 2016; Coppock and Wechsler, submitted; Zu, to appear) EGO-MARKING refers to a subject agreement form; in root clauses, the ego-marking form occurs in first person declarative sentences and second person interrogative sentence. (It is glossed as CONJ, for "conjunct", because of how it functions in embedded clauses; examples from Hargreaves 2005, cited by Coppock and Wechsler 2015.)

(17)   a. j ĩ: a:pwa twan-ā   (Newari)
          1.ERG much drink-PAST.CONJ

          'I drank a lot.'

       b. j ĩ: a:pwa twan-a   lā
          1.ERG much drink-PERF Q

          'Did I drink a lot?'

(18)   a. chã   a:pwa twan-a
          2.ERG much drink-PERF

          'You drank a lot.'

       b. chã   a:pwa twan-ā   lā
          2.ERG much drink-PAST.CONJ Q

          'Did you drink a lot?'

In embedded clauses, it represents a kind of conjunct agreement or non-switch-reference marker, in that (roughly speaking) the ego-marking (conjunct) form appears in an embedded clause when its subject is coreferential with the matrix subjunct. Coppock and Wechsler and Zu show that ego-marked embedded clauses are obligatorily *de se*. In our terms, they can be viewed as *de se* by default, since this interpretation is determined by the verbal form (data from Zu to appear, (19)).

(19)   [*Scenario: a teacher saw a giant pile of paper in the corner of his office. He thought his assistant graded them, when in fact he himself was the one who did the grading. He pointed at that pile of paper and told a colleague, "The grader worked very hard."*]

       a. #guru   dhāl-a   ki   [wa parisram yan-ā].   (Newari)
          teacher say-PST.DISJ that s/he work.hard do-PST.CONJ

          'The teacher₁ said that he₁ worked hard.'

    b. guru   dhāl-a   ki   [wa parisram yat-a].
       teacher say-PST.DISJ that s/he work.hard do-PST.DISJ

       'The teacher$_1$ said that he$_1$ worked hard.'

In Coppock and Wechsler's analysis, the semantics of ego-marking results in the clause being interpreted as a centered proposition, i.e. a set of individual-world pairs, centered on the "epistemic authority" which corresponds to the subject. This semantic type allows them to adopt Lewis's property theory of *de se*.

Coppock and Wechsler have an insightful idea about the discourse function of ego-marked root clauses like (17)-(18). They adopt a framework of discourse meaning in which the individual interlocutors' commitments are represented as "commitment slates" separate from the mutual commitments of the dialogue, the common ground (following Farkas and Bruce 2010; see also Hamblin 1971, Gunlogson 2001, Portner to appear). To this framework, they add the novel idea that commitment slates are not sets of ordinary propositions, as has been assumed previously, but rather sets of centered propositions. Each individual x's commitment slate cs_x is a set of propositions centered on x. In other words, it is encoded within centered proposition which individual's commitments it represents. This means that, when an ego-marked declarative like (17) is used, its sentential force can be read off of its semantic value: within Coppock and Wechsler's theory, the sentential force of an ego-marked declarative is to update the commitment slate of the individual on whom its denotation is centered.[23] As a default, when a centered proposition is added to an individual's commitment slate, the corresponding uncentered proposition is added to the common ground. This step corresponds to the mutual acceptance of information to which the speaker makes an individual commitment.

5.2 Ego-marking in the PPOSW framework

From Coppock and Wechsler's work, I will adopt the central idea that individual discourse commitments are represented using centered denotations. However, I wish to preserve the insights about the relation between verbal mood and sentence mood developed in Section 3, and so I will not adopt their assumptions about the semantic types of declaratives and interrogatives. Instead, I will divide things up as follows:

- Partitionhood

  1. Indicative declaratives and interrogatives denote partitions.

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[23]Note that in their theory, questions are sets of centered propositions, but the discourse structure does not have distinct "question slates" for each participant. Rather there is a single, mutual question set, the Table, which can contain questions centered on various individuals.

    2. Non-indicatives denote lower-type sets.

- Centering

    1. Ego-marked clauses' meanings are centered on the epistemic authority.

    2. Imperatives' meanings are centered on the addressee and a time.

    3. Subjunctives' meanings are centered on a time.

    4. Control infinitives' meanings are centered on an individual and a time.

Putting these points together, we get the following semantic types for some key constructions:

1. A non-ego-marked indicative declarative or interrogative denotes a partition of a set of worlds.

    (a) The declarative's partition is propositional.

    (b) The interrogative's partition is interrogative.

2. An ego-marked indicative declarative or interrogative denotes a partition of a set of individual-centered worlds, where the individual is the epistemic authority.[24]

    (a) The declarative's partition is propositional.

    (b) The interrogative's partition is interrogative.

3. An imperative denotes a set of individual/time-centered worlds, where the individual is the addressee.[25]

4. A subjunctive denotes a set of time-centered worlds.

5. A control infinitive denotes a set of individual/time-centered worlds.

There are several moods and mood-like forms on which I do not take a formal stand. These include subjunctive interrogatives like (12), wh-infinitives, non-control (ECM) infinitives, and reportative subjunctives. I will briefly discuss, in Section 5.5, how these forms fit into the theory being developed.

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[24]Wechsler (to appear, 2016) gives evidence that conjunct-marked clauses in Newari and Tsafiki are interpreted *de nunc* (i.e. *de se* in their time argument). This suggests that the partitions associated with ego-marked clauses are also time-centered (i.e. individual/time-centered partitions). More work is required to understand the relation between ego-marking and tense and the effects which the *de nunc* interpretation has on sentential force of ego-marked root declaratives and interrogatives, so I will set aside the temporal features of these clauses for now.

[25]This analysis of imperatives is virtually equivalent to those which assign it the type of a property (Hausser, 1980; Portner, 2004, 2007). Ideally we would be able to identify the addressee in imperatives in a way similar to the epistemic authority relevant to ego-marking (the speaker in ego-marked declaratives and the addressee in ego-marked interrogatives). The agent of an action is in some sense the "authority" for that action.

5.3 The model: extension of the logical framework

We need a formal model which can incorporate the contributions of both centered and uncentered meanings at the partition-level and lower-level types. To this end, we will allow both partitions of sets of worlds, and partitions of sets of centered worlds. At the same time, we are going to allow for the possibility of tracking multiple ordering relations at once. So our two structures will be the PMOSW ("partitioned, multiply ordered set of worlds"[26]) and the PMOSCW ("partitioned, multiply ordered set of centered worlds").

- A PMOSW $s = \langle p_s, <_{1,s}, <_{2,s}, \ldots \rangle$, where

    1. p_s is a partition of a set of worlds c_s, and
    2. Each $<_{n,s}$ is a partial ordering of c_s-worlds.

- A PMOSCW $s_i = \langle p_{s_i}, <_{1,s_i}, <_{2,s_i}, \ldots \rangle$, where

    1. p_{s_i} is a partition of a set of i-centered c_{s_i} worlds, and
    2. Each $<_{n,s_i}$ is a partial ordering of i-centered c_{s_i}-worlds.

In what follows, the only type of centered worlds we will use in detail are those centered on an individual. We will not use time-centered worlds in the discussion, even though we need them to analyze subjunctives. Nor will we incorporate worlds centered on an individual/time pair into the model, though these are needed to account for the temporal semantics of infinitives and imperatives. The reason for this gap is simply that I do not yet fully understand the role played by time in the discourse context and agent's cognitive model. Though there is important work on the temporal orientation of infinitives and attitude predicates,[27] it will take some work to connect it to the future-orientation of non-finite root clauses (imperatives and unembedded subjunctives and infinitives).

Next we define both the discourse context and an agent's cognitive model using the constructs PMOSW and the PMOSCW.

- The DISCOURSE CONTEXT D is a set $\{m, cs_1, \ldots, cs_n\}$, where:

    1. The mutual commitment slate m is a PMOSW,
    2. Each individual commitment slate cs_i is a PMOSCW, and

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[26]It could be called the "partitioned, multiply partially ordered set of worlds", but in my opinion that would be taking the spirit of trying to avoid overselling the system's elegance too far.

[27]On this issue, see Stowell (1982), Portner (1992, 1997), Condoravdi (2002), Abusch (2004), Roberts (2009) and Klecha (2016) for ideas.

3. The set of PARTICIPANTS in D is the set of individuals i on which some cs_i is centered.

Within D, the common ground and shared priorities are encoded in the mutual commitment slate m and in addition each of the participants has an individual commitment slate cs_i

- An individual a's COGNITIVE MODEL in situation e is a PMOSCW centered on a, where:

  1. The domain of the partition $c_{m(a,e)}$ represents a's beliefs in e, and
  2. Each of the orderings $<_{n,m(a,e)}$ represents a type of priority for a in e.

We will assume for simplicity that there is only one ordering in the cognitive model $<_{1,m(a,e)}$ and that it represents a's desires in e. We can refer to it as $<_{des(a,e)}$. As before, we ignore the partition structure in $m(a,e)$ because it is meant to model the individual's private inquiries — roughly what she wonders or is interested in knowing. We won't use this piece in our analysis until we understand interrogative subjunctives better.

Since we have enriched our ideas about the discourse context and cognitive model to include multiple orders and centered objects, we need to adjust the definitions of the update operations.

- **Reduce**: For any PMOSW or PMOSCW s and sentence ϕ which denotes a partition matching s in the identity of its center (if any),
  $$s \oplus \phi = \langle p_s \cap [\![\, \phi \,]\!]^s, <_s \rangle.$$

  1. When $s \oplus \phi$ shrinks c_s (the domain of p_s), we call it an **assertive update**.
  2. When $s \oplus \phi$ subdivides the cells of p_s, we call it an **inquisitive update**.

- **Refine**: For any PMOSW or PMOSCW s and sentence ϕ which denotes a set of worlds or centered worlds matching an order $<_{n,s}$ in the identity of its center (if any),
  $$s \star_n \phi = \langle p_s, <_{n,s} \circ [\![\, \phi \,]\!]^s \rangle.$$

- **State update**: For any PMOSW or PMOSCW s and sentence ϕ, $s + \phi$ is whichever of the following are defined: $s \oplus \phi$ or $s \star_n \phi$, for some n.

- **Discourse update**: For any discourse context D and sentence ϕ, $D + \phi$ is whichever of the following are defined: $s + \phi$, for some $s \in D$.

State update seeks out some type-matching component of s and updates it with the appropriate version of $\oplus$ or $\star$. Discourse update seeks out some appropriate component of the

discourse and state-updates it. Note that both forms of update are now in principle non-functional relations, since it could be that there are multiple orders within the state, and it's ok for a non-partition ϕ to modify any of them. But we will not deal with such cases here.[28]

5.4   Individual commitment and contextual ordering

The formalization of the discourse context given above is similar to those of Hamblin (1971), Farkas and Bruce (2010), and related work, in that it has separate components for the mutual commitments and each individual's commitments. As discussed by Farkas and Bruce, Coppock and Wechsler (submitted), Portner (to appear) and others, there are relations between the mutual and individual commitments. One type of relation will follow from the general fact that the state of the discourse is itself mutual information; so, if having drunk a lot is on Sally's individual commitment slate, it should be in the common ground that Sally is individually committed to having drunk a lot. But beyond this type of thing, there are important relations which are intrinsic to the intended interpretations of the mutual and individual commitment slates.

In this section, I will try to formalize two principles which go under the slogan "individual commitments are soft mutual commitments". The first of these says that, if a participant in a conversation is committed to a belief p, all participants are licensed to talk as if p is more likely that $\neg p$. The second says that, if an individual is committed to a preference P, all participants are licensed to talk as if P is a better outcome that *not-P*. Often, an individual commitment goes from being a soft mutual commitment to a hard mutual commitment. This is the sequence seen when an individual expresses an opinion (individual commitment) that p, which other participants treat as evidence (soft mutual commitment) that p, before sooner or later (usually sooner) accepting p as a fact (hard mutual commitment).[29]

Coppock and Wechsler describe the first type of relation. They say that when an individual takes on an individual commitment by asserting an ego-marked clause, by default the uncentered proposition corresponding to the denotation of that clause will enter the common ground. For example, if Sally takes on an individual commitment to having drunk a lot, by default it will become common ground that she drank a lot. The reason for this relation is obviously that Sally's individual commitment to having drunk a lot counts as a good reason to believe that she drank a lot. In other words, there is a respect in which a world w in (one of the pairs in) c_{cs_i} is more likely than an otherwise similar world v not in (one of the pairs of) c_{cs_i}. It is more likely "in view of i's expressed beliefs". This likelihood relation is one of

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[28]The idea that there are multiple stores of prioritizing information in the context — multiple sub-to-do-lists — was explored by Portner (2007).

[29]This sequence of steps is very similar to what happens in Murray's (2014) theory of grammatical evidentiality, and I believe it would prove insightful to incorporate the chief ideas of her theory into the framework sketched here.

the orderings in D.[30]

- If $cs_i \in D$, then one ordering relation in m is $<_{bel(i)} = \{\langle w, v \rangle : w \in c_{cs_i(i)}$ and $v \notin c_{cs_i(i)}\}$.

We can think of this as the individual commitments of i being treated as a type of evidence. The ordering $<_{bel(i)}$ can be merged with other likelihood orderings in m to produce a useful ordering source (Katz et al., 2012).

There are also relations between the ordering components of an individual commitment slate and the mutual commitments. Suppose that Sally expressed a preference to have a coffee, so that centered worlds in which has has a coffee are higher-ranked than otherwise similar centered worlds in which she does not, according to one of the orderings in her commitment slate. Then by default there will be a mutual preference in discourse that she gets her coffee. The relation between cs_i and m is as follows:

- If $cs_i \in D$ and $<_{n,cs_i} \in cs_i$, then one ordering relation in m is the uncentered ordering $<_{k,cs_i}(i)$.

The ordering $<_{k,cs_i}(i)$ can be used as a buletic ordering source, "in view of what i wants".

5.5 The semantics of verbal mood and the derivation of sentential force

The goal of this section has been to revise the theory of the relation between verbal mood and sentence mood presented in Section 3 so as to take into account the idea that saturated and unsaturated meanings (that is, uncentered and centered propositions or partitions) are specialized for different sematic roles. Now we return to some of the basic examples which illustrate the semantic functions of each sentence mood and verbal mood. The key idea is that the semantic type of each clause can drive the right interpretive process for both unembedded (sentence mood) and embedded (verbal mood) examples. In this section, I want to show that the idea works for the simplest range of examples: root declaratives, interrogatives, and imperatives used in their most literal way, embedded indicatives under 'believe', and embedded infinitives under 'want'.

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[30]$cs_i(i)$ is the set of worlds w which are paired with i in cs_i. The notation is meant to suggest "uncentering" cs_i by applying it to i, as the operation is described by Coppock and Wechsler. Below I employ a similar notation $<(i)$ for the ordering which holds between two worlds w and v iff $\langle i, w \rangle < \langle i, v \rangle$.

Considerations of compositionality.   We begin with the necessary hypotheses (not yet packaged as a formal fragment) about the internal semantics of mood:

1. The core clausal constituent of simple sentences (let's call it vP) consists of the verb and its internal arguments. Its denotation is a property of individuals and times, or equivalently an individual/time-centered proposition.

2. Imperative morphosyntax restricts the subject's argument to the addressee, but does not change the clause's type.

3. Subjunctive saturates the subject argument but not the time argument. A subjunctive denotes a set of time-centered worlds.

4. Indicative bundles two semantic operations:[31]

   (a) It saturates both the individual and time arguments.
   (b) It raises the clause's type to that of a propositional partition, mapping p to $p \times p$.

   As a result, an indicative denotes a propositional partition of a set of (uncentered) worlds.

5. Wh-items subdivide the partition.[32] As a result, an indicative interrogative denotes an inquisitive partition of a set of (uncentered) worlds.

Examples.   Some illustrative examples will show how these assumptions work with the definitions of discourse context and cognitive model to explain the relation between verbal mood and sentence mood. The idea is that in each derivation, we see the meaning of a clause drive the appropriate form of the update operation $+$ to derive the correct sentential force (for root clauses) or subsentential modal meaning (for embedded ones).[33]

- **Root declarative.** The declarative denotes an uncentered partition and it therefore updates the partition component of the discourse's mutual commitments:

  (20) $[\![\text{ Alice left }]\!]^c = \{\langle w, v\rangle : \exists t_{\prec time(c)} [\text{ Alice leaves at } t \text{ in } w] \wedge$
  $\exists t_{\prec time(c)} [\text{ Alice leaves at } t \text{ in } v]\}$

  (21) $D + [\![\text{ Alice left }]\!]^c$:
  Update p_{m_D} to $p_{m_D} \cap [\![\text{ Alice left }]\!]^c$

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[31] Below I will discuss the kinds of systems which can be derived when these operations are separated.

[32] This is close to Lohnstein's (2007) analysis of the relationship between declarative and interrogative sentence mood. Alternatively, if we think the wh-item has scope under indicative, it would create a proposition set which indictive subsequently converts to an interrogative partition.

[33] The approach here is in some ways similar to that of Farkas (2003).

- **Root interrogative.** The interrogative denotes an uncentered partition and it therefore updates the partition component of the discourse's mutual commitments:

  (22) $[[$ *who left* $]]^c = \{\langle w, v\rangle : \{x : \exists t_{\prec time(c)} \; x \text{ leaves at } t \text{ in } w\} =$
  $\{x : \exists t_{\prec time(c)} \; x \text{ leaves at } t \text{ in } v\}\}$

  (23) $D + [[$ *Alice left* $]]^c$:
       Update p_{m_D} to $p_{m_D} \cap [[$ *Alice left* $]]^c$

- **Root imperative.** The imperative denotes a property of the addressee. Since this property is equivalent to an addressee-centered proposition, it updates an ordering component of the addressee's commitment slate.

  (24) $[[$ *Leave!* $]]^c = [\lambda x \lambda w \; : \; x = addressee(c) \; . \; \exists t_{\succ time(c)} \; x \text{ leaves in } w \text{ at } t]$

  (25) $D + [[$ *Leave* $]]^c$:
       Update some $<_{n,cs_{addressee(c)}}$ to $<_{n,cs_{addressee(c)}} \circ [[$ *Alice left* $]]^c$

  (Keep in mind that I am not trying to give a correct analysis of the imperative's temporal argument here.)

- **Embedded infinitive.** The infinitive denotes a property of individuals. Since a property is equivalent to an individual-centered proposition, it updates the subject's desires.

  (26) $[[$ *to leave* $]]^c = [\lambda x \lambda w \; . \; \exists t_{\succ time(c)} \; x \text{ leaves in } w \text{ at } t]$

  (27) $[[$ *Bob wants to leave* $]]^c =$
       $[\lambda w \; . \; \exists e_w \; m(a,e) + to \; leave = m(a,e)] =$
       $[\lambda w \; . \; \exists e_w \; m(a,e) \star to \; leave = m(a,e)] =$
       $[\lambda w \; . \; \exists e_w \; <_{des(a,e)} \circ [[$ *to leave* $]]^c = <_{des(a,e)}]$

  (Keep in mind that I am not trying to give a correct analysis of the infinitive's temporal argument here.)

- **Embedded indicative.** The indicative denotes an uncentered partition, and it therefore cannot immediately update any component of the subject's cognitive model. It is shifted to the type of centered partition.[34]

  (28) $[[$ *that Alice left* $]]^c = \{\langle x, w\rangle, \langle x, v\rangle : \exists t_{\prec time(c)}[\text{ Alice leaves at } t \text{ in } w] \wedge$
  $\exists t_{\prec time(c)}[\text{ Alice leaves at } t \text{ in } v]\}$

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[34]I do not take a stand on whether this shift is the result of a syntactically represented operator or an interpretation-driven type shift.

(29)   [[*Bob thinks that Alice left*]]^c =
          [λw . $\exists e_w$ $m(a,e)$+*that Alice left* = $m(a,e)$] =
          [λw . $\exists e_w$ $m(a,e)$⊕*that Alice left* = $m(a,e)$] =
          [λw . $\exists e_w$ $c_{m(a,e)}$ ⊆[[*that Alice left*]]^c]

The shift to centered partition would also allow for some pronoun in the clause to be bound, leading to an (optional) *de se* meaning.

In this framework, indicatives produce reducing updates, and those updates are assertive or inquisitive depending on whether the clause denotes a propositional or an interrogative partition. In root clauses, the reducing update amounts to a sentential force of assertion or asking; in an embedded clause, it produces a standard propositional attitude semantics (based on the dynamic implementation due to Heim 1992). Imperatives, infinitives and subjunctives (the last of these not exemplified in this section) produce refining updates. With a root imperative, the refining update targets the addressee's commitment slate and produces a directive meaning; with an embedded infinitive, it leads to a comparative modal semantics and a *de se* interpretation of the subject.

In the simple system sketched above, we have a main two-way distinction in mood between saturated partitions (indicative declaratives and interrogatives) and unsaturated properties (imperatives and infinitives). This system comes about because of two simplifying assumptions: (i) we only consider saturation of the subject argument, and (ii) the saturation and partitioning operations occur together. If we distiguish saturation of the subject argument from saturation of the time argument, and separate saturation and partitioning, we have three operations to work with, potentially creating eight different moods. Let S be the operation which saturates the subject, T the operation which saturates the time argument, and P the operation which partitions a set-level denotation.

1. None: individual-time centered proposition = control infinitive

2. S: time-centered proposition = infinitive with subject, subjunctive

3. T: individual-centered proposition = ?? (C)

4. P: individual-time centered partition = ?? (B)

5. ST: uncentered proposition = ?? (D)

6. SP: time centered partition = ?? (A)

7. TP: individual-centered partition = ego-marked clause[35]

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[35]This is the denotation of an ego-marked clause according to Coppock and Wechsler. However, as noted above, research on its temporal argument may lead to other conclusions about where it fits in.

8. *STP*: uncentered partition = indicative declarative or interrogative

The gaps in this classification may be filled by some of the clausal constructions which are not currently well-understood within semantics and pragmatics. I would suggest that category A may correspond to interrogative subjunctives and those subjunctives which are not selected by a comparative predicate, such as reportative subjunctives.[36] Category B would be a natural fit for interrogative control infinitives (*who to talk to*), and in fact treating such infinitives as individual-time centered partitions fits well with Roberts' (2009) analysis.[37] Category C should include third person imperatives (Mastop 2011; Zanuttini et al. 2012; Portner 2013), used to update mutual preferences with the same temporal orientation as a standard imperative, while category D would be a mood which updates the mutual preferences with a fixed temporal parameter. I do not know of any good candidates for category D.

One component of this framework which has not been investigated in sufficient detail concerns the step of restricting an unsaturated argument without saturating it. I have appealed to an operation which restricts the subject both for imperatives, where the subject is restricted to the addressee but the denotation remains a property (or centered proposition), and ego-marked clauses, where Coppock and Wechsler propose that the subject is not saturated but restricted to the epistemic authority (speaker in declaratives, addressee in interrogatives). It might be possible to unify these two ways of affecting the subject argument by better understanding the relevant concept of "authority", since the addressee is intuitively the authority over whether the action described by an imperative is performed.

One final important set of issues left open by the hypotheses laid out here concerns interrogative subjunctives and subjunctives not triggered by comparison (such as reportative subjunctives and polarity subjunctives). I have speculated that these might have a different interpretation from the subjunctives which are within the purview of the comparison-based theory (i.e. category A above), a meaning more similar to ego-marked clauses. Indeed, it does seem reasonable to relate reportative subjunctives to ego-marking, in that both of them relate to some individual's commitment slate. However, we cannot leap to postulating a second subjunctive which denotes a centered partition, for two reasons: First, we do not yet have an understanding of the function of a time-centered partition in the cognitive model, though this is a facet of the general need to understand the temporal semantics of verbal mood better. And second, we do not yet have evidence for such subjunctives surfacing as root clauses. We would either need to find root clauses which have the appropriate meanings, or give an explanation of their absence within the theory of sentence mood.

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[36]ECM infinitives would presumably be quite similar to this type of subjunctive.

[37]Roberts builds on unpublished work by Dowty and Jacobson (1991).

Acknowledgements

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