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A preference semantics for imperatives*

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Abstract Imperative sentences like *Dance!* do not seem to represent the world. Recent modal analyses challenge this idea, but its intuitive and historical appeal remain strong. This paper presents three new challenges for a non-representational analysis, showing that the obstacles facing it are even steeper than previously appreciated. I will argue that the only way for the non-representationalist to meet these three challenges is to adopt a *dynamic semantics*. Such a dynamic semantics is proposed here: imperatives introduce preferences between alternatives. This characterization of meaning focuses on what function a sentence serves in discourse, rather than what that sentence refers to (e.g., a state of the world). By representing the meaning of imperatives, connectives and declaratives in a common dynamic format, the challenges posed for non-representationalism are met.

Keywords: Imperatives, Dynamic Semantics, Modality, Expressivism

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1 Introduction

It seems like a platitude that imperative sentences like *Dance!* do not represent the world. Surely they instead direct the addressee to make the world a certain way. The historical and intuitive appeal of this idea remains strong, but it has been challenged by recent work on imperatives. Section 2 presents three new challenges for this appealing idea: imperatives interact with connectives and contextual information, and bear consequence and consistency relations in ways that are hard to capture on a non-representational semantics. Section 2.1 is the highlight of this discussion, where I argue that no static (non-dynamic) non-representational semantics can capture the way imperatives, declaratives and sentential connectives interact — modulo another constraint motivated there. New data is presented there which shows that English and other languages allow imperatives to embed under disjunction and conjunction while clearly maintaining their standard meaning. I will then sketch a dynamic account in §3 whose basic ideas are as follows:

Basic Analysis

i. Imperatives introduce preferences between alternatives
ii. Declaratives provide information
iii. Conjunction sequences the effects of its conjuncts
iv. Disjunctions create competing 'substates' for each disjunct where that disjunct has had its standard effect

Components (i) and (iv) are the key innovations here. (iv) in particular addresses major limitations in the way previous non-representationalists like Portner 2004, 2012 and Charlow 2014 have analyzed disjunction. Section 4 provides a specific formalization of these ideas in a propositional logic. Even this very basic implementation suffices to meet the challenges for non-representationalism from §2.

It is important to be clear at the outset about what exactly a *non-representational semantics* for imperatives is. Some might take a non-representational semantics to mean that the semantic value of an imperative is not a proposition in Stalnaker's (1976) sense: a set of worlds. On examination, this is a rather naive construal of *non-representational*. The key idea to be captured here is that the discourse function of an imperative is not to represent the world. In principle, a set of worlds could be used to model that discourse function: worlds included in the set could capture ways the world *should be*.[1]

A more sophisticated definition of non-representationalism focuses on discourse function, rather than semantic type:

Non-Representational Semantics $[\![\phi]\!]$ is non-representational just in case the primary discourse function of $[\![\phi]\!]$ is not to rule out ways the world could be.

Two exemplars of this approach are Portner 2004 and Charlow 2014. According to Portner 2004, $[\![!\phi]\!]$ is a property of the addressee, namely the property of the addressee making it the case that ϕ. It serves to update their To-Do List, constraining what actions the addressee may rationally take, rather than what the world is like.[2] Charlow's (2014) theory can be understood as taking $[\![!\phi]\!]$ to be a property of plans, namely the property of requiring that the addressee act so as to make ϕ true. Plans are formal constructs that encode the agents' policies for what to do across a range of possible circumstances.[3] This way of thinking about non-representational accounts also extends to von Fintel & Iatridou 2017 which holds that imperatives do not *semantically* encode any directive meaning like Portner 2004, but unlike Portner 2004 that imperatives do not always function in discourse to update the To-Do List.

By contrast, the modal analyses of Aloni 2007 and Kaufmann 2012 take $[\![!\phi]\!]$ to be a modal proposition whose primary discourse effect is to say what

1 Murray & Starr (2020: §2.2) draw on recent theories of propositions (e.g., King, Soames & Speaks 2014) to develop this point into an argument against Portner's (2004) proposal to pragmatically infer discourse function from semantic type. But the proposal to follow about non-representationalism is neutral with respect to Portner's (2004) proposal.

2 Formally, a property is a function from individuals and worlds to truth values. A To-Do List is a function from individuals to sets of properties, namely the set of properties that individual is to make true (Portner 2004).

3 Charlow 2014 constructs plans from *action-descriptors*. This novel construct makes comparison with other theories difficult. Yalcin 2012: §10 provides a more familiar formalization starting with a hyperplan h, which is a function from a set of worlds s, to another set of worlds $h(s) \subseteq s$. Intuitively, h encodes what an agent is to do when in one of the worlds from s: act so as to prevent any of the worlds not in $h(s)$ becoming actual. Charlow's (2014) theory can be recast as: $[\![!\phi]\!]_c = \{h \mid h(c) \subseteq [\![\phi]\!]_c\}$, where c is the context set of the conversation (Stalnaker 1978). Just as a declarative utterance updates the context set by intersection (Stalnaker 1978), an imperative utterance updates a set of hyperplans by intersection. I must note however that Charlow 2014 offers this only as a necessary condition on a theory of imperatives, so '=' should be '⊆'. I'll ignore this for concreteness, ensuring no criticism turns on it.

the world is like. Indirectly, this results in accommodating a change to the modal's contextual parameters, ensuring that the modal proposition denoted by $!\phi$ is true. Similarly, Condoravdi & Lauer 2012 analyzes $[\![!\phi]\!]$ as a proposition about the speaker's preferences which cannot fail to be true if $!\phi$ is felicitously uttered. Its discourse function is to represent how the speaker's preferences are in the actual world.

On the analysis I will propose below, $!\phi$ directly changes the *preferences* mutually assumed in a discourse. As will become clear, this operation on preferences has radically different formal properties than the way declaratives change the *information* mutually assumed in a discourse. Imperatives are motivational, and plausible abstract models of motivational mental states have very different features from those for representational states. This paper focuses on non-representational analyses, but §5 will briefly discuss representational ones. I will also explain there how the semantics of imperatives underdetermines the force of imperative speech acts.

2 Three challenges

Beginning with truth-tables and ending with operations on sets of worlds like intersection and union, the story of connective meanings focuses on representational language. If one takes the semantic value of $!\mathsf{A}$ to be non-representational, it raises the question of whether these familiar stories can be adapted to a non-representational end. At first glance, it doesn't look to be a problem for non-representational analyses like Charlow 2014 and Portner 2004. There is no obvious barrier to treating $!\mathsf{A} \wedge !\mathsf{B}$ as intersecting properties (Portner 2004) or sets of plans (Charlow 2014). However, things get more interesting with disjunctions and hybrid conjunctions like $\triangleright\mathsf{A} \wedge !\mathsf{B}$, where $\triangleright$ is a declarative operator. Section 2.1 argues that there are natural language sentences corresponding to these forms (§2.1.1), and that it is not possible to explain how the declarative and imperative components of these sentences have their distinct discourse effects without embracing some form of dynamic semantics (§2.1.2). This is the first challenge, which prefigures two related challenges.

2.1 Challenge 1: imperatives under connectives

Can sentential mood (imperative, declarative, interrogative) scope under sentential connectives like *and* and *or*? This has been a controversial question among philosophers and received limited, but increasing, attention by linguists.[4] With imperatives, previous work has focused on combinations, like (1–4), that receive conditional interpretations.

(1) Fly to Harare and I'll meet you there.

(2) Piss off a Texan and you'll be sorry.

(3) Make tortillas and you'll need flour.

(4) Move to Portland or you'll never relive the 90s.

These enigmas deserve attention and are the focus of an extensive literature (e.g., Lascarides & Asher 2003, Russell 2007, Kaufmann 2012, von Fintel & Iatridou 2017), including Starr 2017 which analyzes it within the semantics proposed in §4. But they are not ideal evidence of imperative mood scoping under connectives. It is controversial in this literature whether the conditional readings really arise from the standard meaning of the connectives and imperative mood. Section 2.1.1 will provide more conclusive data, and §2.1.2 will make clear the challenge this data poses for non-representational static theories.

2.1.1 The data

We've just arrived home in Santa Fe after years away. We need some good New Mexican food. I propose a plan:[5]

(5) I'll make the chile and you make the tortillas!

(6) a. $\left\{\begin{array}{l}\text{\#So}\\\text{\#But}\end{array}\right\}$ don't make tortillas

b. $\left\{\begin{array}{l}\text{\#So}\\\text{\#But}\end{array}\right\}$ I won't make the chile

Both (6a) and (6b) are infelicitous as follow-ups to (5), showing that the speaker commits themselves to both the directive and informative conjuncts. As observed by Starr 2017, this property is not shared with other conjunctions of

4 *No*: it's a conceptual confusion (Frege 1923: pp. 2–3) and empirically unmotivated (Dummett 1973: Ch.10). *Yes*: for all moods and connectives (Searle 1969: p. 13), or maybe just some (Asher 2007, Krifka 2014). Related work demonstrates an interaction between mood and quantification (Krifka 2001), embedding verbs (Crnič & Trinh 2009) and evidentials (Bittner 2008, Murray 2010a).

5 The first conjunct in (5) is a first-person future declarative, but other forms are possible: *Mom is making the chile and you make the tortillas.*

imperatives and declaratives, where the first conjunct can be contradicted. Suppose you are deciding whether to make corn or flour tortillas, and are contemplating whether to also make beans.

(7) a. Make flour tortillas and Mom will complain.

b. $\left\{ \begin{array}{l} \text{So} \\ \text{\#But} \end{array} \right\}$ don't make flour tortillas.

(8) a. Make beans and you'll need epazote.

b. $\left\{ \begin{array}{l} \text{\#So} \\ \text{But} \end{array} \right\}$ don't make beans (they'll take too long)

The negative connotation of the second conjunct in (7a) not only makes contradicting the first felicitous, it makes it manifest enough to license *so*. (8a), by contrast, can just serve to remind you what's needed to make beans — needing epazote may have neither positive nor negative value for the proposal of making beans. This neutral interpretation of the directive conjunct allows contradiction, although it is more felicitous with the contrast marker *but*. Conjunctions like (7a) and (8a) are set aside here.

There may still be doubt about the second conjunct of (5) being a true imperative, since it has an obligatory subject. Note that (5) doesn't change meaning upon reversal.

(9) a. Make the tortillas and I'll make the chile!

b. $\left\{ \begin{array}{l} \text{\#So} \\ \text{\#But} \end{array} \right\}$ don't make tortillas.

This equivalence, and the true imperative nature of the first conjunct of (9), suggests that the second conjunct of (5) is a true imperative. Further, this reversibility demonstrates that the *and* in (9) must be true conjunction, not a potentially special interpretation of *and* as in examples like (7) and (8). Further, switching to a negative imperative in the second conjunct eliminates the troubling obligatory subject.[6]

(10) I'm going home and don't (you) try to stop me!

Even stronger evidence is available from languages that explicitly mark sentences for imperative mood. Consider the Plains Algonquian language Cheyenne which marks sentences for mood using verbal suffixes, much as English

6 I thank Magdalena Kaufmann for suggesting I find an example of this form.

marks tense with verbal suffixes. Cheyenne moods include declarative, interrogative and imperative — declarative being the unmarked member of the mood paradigm (Murray 2016).[7] A conjunction with a declarative and an imperative is felicitous in a context like the following. We often perform a song and dance together. Sometimes, I sing and you dance. Other times you sing and I dance. We are planning for a performance, and I decide that I want to sing. I can communicate this by:

(11) Ná-to'se-néméne naa ho'sóe-**o'o**! (Murray 2016)
1-going.to-sing and dance-DEL.IMP.2SG
'I am going to sing and (you) dance (then)!'

Indeed, once one looks to languages that explicitly mark mood, a simple conjunction of imperatives also suggests an analysis where *and* scopes under mood. Cheyenne (13) clearly contains two imperative morphemes (in bold) under the conjunction *naa*.[8]

(12) Everybody dance and somebody sing!

(13) Némene-**o'o** naa ho'sóe-**o'o**! (Murray 2016)
sing-DEL.IMP.2SG and dance-DEL.IMP.2SG
'Sing (later) and dance (later)!'

The flexibility to combine imperatives with declaratives is not limited to conjunction. Similar examples exist with *because*, *so* and *unless*.

(14) Donate blood because vampires will starve otherwise.

(15) a. Donate some blood so a vampire can eat peacefully tonight.
b. I'll make the chile so make the tortillas!

(16) Leave a donation unless you cannot afford it.

Disjunction is slightly more nuanced, but there too imperatives embed.[9] Suppose we're at a used book sale to stock our joint library. We've each found

7 Cheyenne contains two imperative forms: immediate and delayed. Only the delayed can occur in (11). The immediate cannot generally be conjoined without a prefix *no'*-, meaning *also*, on the second verb (Murray 2016).

8 It is theoretically possible to explain away such occurrences in terms of across-the-board movement for imperative morphemes, or to treat them as mere agreement markers with a higher covert imperative operator. Since such an analysis would not work for hybrid conjunctions like (11), and would require justifying these syntactic posits, the burden of proof lies with those who wish to deny that (12) involves embedded imperatives.

9 Krifka 2014 conjectures that imperatives won't embed in disjunctions.

three books, but we only have enough cash for five books. One of us has to put a book back. I suggest:

(17) a. *Me*: Put back *Waverly* or I'll put back *Naked Lunch*. I don't care which.
(*Me*: I'll put back *Naked Lunch* or you put back *Waverly*. I don't care which.)
b. *You*: I'm fine with either too.

Unlike (4) and (18a), this disjunction does not have a negative conditional meaning. This is clear from its reversibility and from the fact that these others cannot be followed with either indicator of a free-choice reading: *I don't care which* and *I'm fine with either too*.

(18) a. *Me*: You put back *Waverly* or I'll burn your signed edition of *Vineland*! (#I don't care which.)
b. *You*: #I'm fine with either too.

It is tempting to assume that conditional imperatives have an embedded imperative consequent.

(19) If Chris tries to leave, close the door!

But perhaps an imperative operator is taking scope over the entire conditional, meaning *Make it the case that if Chris tries to leave, you close the door!* The wide-scope analysis is problematic given examples like:

(20) If Chris tries to leave, I'll distract him and you close the door!

How could a wide-scope analysis prevent the bizarre prediction that the imperative being conditionalized is the whole consequent: *I distract him and you close the door*? Since the wide-scope analysis has largely been motivated by despair at a narrow-scope analysis, I hope even the most staunch defenders of a wide-scope analysis will admit that a narrow-scope analysis would be worth seeing.[10]

While imperatives clearly embed under connectives, it is important to grant that there are limitations on when such combinations will yield a coherent discourse move. The embedding facts show that a compositional semantic theory is needed to explain how these structures are interpretable at all. But it is equally important to stress, as Asher (2007: p. 212) does, that

10 See Charlow 2014: §2.3 for other arguments against the wide-scope analysis.

a theory of discourse coherence is needed to explain why certain syntactic combinations are pragmatically incoherent. I will focus on the semantic challenge here: to interpret these constructions without positing ambiguous connectives and without blurring the differences between imperatives and declaratives. But it must be kept in mind that this is only a partial explanation which will need to be integrated with a theory of discourse coherence (Asher & Lascarides 2003, Kehler 2004, Beaver et al. 2017).

2.1.2 The challenge: why dynamic semantics is necessary

Given the data above, it is clear that imperatives and declaratives embed in conjunctions and disjunctions. This fact interacts with a non-representational analysis of imperatives in a very surprising way. When another plausible constraint is assumed, it entails that one cannot adopt a *static* non-representational analysis of imperatives. This section details the argument for this surprising claim.

On a static analysis, a sentence's semantics does not directly encode its discourse function. It simply encodes a content like a proposition or a property, and pragmatic discourse rules determine how that content affects discourse context. Portner 2004, 2007, 2012 and Charlow 2014 are exemplars of the static, non-representational analysis. For concreteness, I'll focus on the Portner 2004 analysis, but what I'll say applies equally well to Charlow 2014. For Portner 2004, 2007, 2012, an imperative denotes a property (a function from worlds and individuals to truth-values), and that's all the semantics says. The semantics is supplemented with:

Pragmatic Update Principles (Portner 2004)

1. If a matrix clause denoting a set of worlds has been felicitously uttered, update the Common Ground with that set of worlds.
2. If a matrix clause denoting a property has been felicitously uttered, update the addressee's To-Do List with that property.

The To-Do List serves a different function than the Common Ground (Portner 2004), which models the information about the world that is mutually assumed. The fact that imperatives influence the To-Do List rather than the common ground is what makes this approach non-representational. But this is a static semantic analysis because this influence on a To-Do List is *not* part of an imperative's compositional semantics. The plausibility of a static account goes hand-in-hand with:

The Static Thesis

> A sentence's update effect is not recursively computed from the update effect of its parts, and the sentence's syntactic structure.

This thesis is the only principled grounds on which a static analysis could be preferred to a dynamic one where a sentence's compositional meaning is identified with its update effect.[11] After all, if this thesis is wrong then update effects have the characteristic features of a semantic effect.

Consider now a hybrid sentence like $\triangleright\mathsf{A} \wedge !\mathsf{B}$. One does not want to actually combine the contents by intersection, since that will impede each conjunct having a distinct discourse function, as required by non-representationalism. One way forward is to take conjunctions to denote pairs of contents, one for each conjunct. So $\triangleright\mathsf{A} \wedge !\mathsf{B}$ will denote $\langle a, B\rangle$, where a is the proposition denoted by $\triangleright\mathsf{A}$ and the property denoted by $!\mathsf{B}$ is B. One way to proceed is to posit an additional pragmatic principle:

3. If a matrix clause denoting a pair has been felicitously uttered, update the Common Ground with any sets of worlds in the pair, and update the To-Do List with any properties in the pair.

It is interesting to consider this principle with respect to the Static Thesis. 3 does not technically violate the Static Thesis because the cumulative pragmatic theory of 1-3 is not strictly speaking recursive: 3 does not explicitly refer to 1 and 2. However, it effectively simulates a theory which says that the update effect of a conjunction is determined by the update effects of its conjuncts. What limitations does this non-recursive pragmatic theory have, which a recursive semantic theory would not?

The first limitation of 3 is that it assumes the conjuncts are themselves simple content types. For this reason it does not capture a simple embedding like $(!\mathsf{A} \wedge !\mathsf{B}) \wedge \triangleright\mathsf{C}$. This would generate a content like $\langle\langle A, B\rangle, c\rangle$ to which 3 does not correctly apply. One could try to engineer around this difficulty by flattening the hierarchical structure of conjunctions, instead treating them as n-tuples of contents, e.g., $(!\mathsf{A} \wedge !\mathsf{B}) \wedge \triangleright\mathsf{C}$ would denote $\langle A, B, c\rangle$. This would

11 See also §5 where it's clarified that a dynamic semantics does not entail that a sentence's semantics encodes its entire effect, or force, on discourse context. It merely places a constraint on force.

even allow one to compress 1-3 into a single update rule, if one lifts the types of imperatives to unit sequences of properties and declaratives to unit sequences of sets of worlds:

0. If a matrix clause denoting $\langle x_1, \ldots, x_n \rangle$ has been felicitously uttered, update the Common Ground with any sets of worlds from $x_1, \ldots, x_n$ and update the To-Do List with any properties from $x_1, \ldots, x_n$.

But this strategy is short-sighted. It assumes that conjunction is the only way of forming complex content types.

As shown above, imperatives also embed under disjunction. How can the strategy above be applied to $!\mathsf{A} \wedge (!\mathsf{B} \vee !\mathsf{C})$? A new kind of complex content will be needed to capture disjunctions, perhaps a set of contents (Portner 2012), so $!\mathsf{B} \vee !\mathsf{C}$ will denote $\{B, C\}$ — temporarily set aside the question of how to update with this content. So for $!\mathsf{A} \wedge (!\mathsf{B} \vee !\mathsf{C})$, one gets the content $\langle A, \{B, C\} \rangle$. The problem encountered with complex conjunctions, and allegedly solved by moving to *n*-tuples, re-arises. But this angle on the problem makes it much clearer that a static theory cannot solve it and why. One cannot modify 0 to read:

0.1. If a matrix clause denoting $\langle x_1, \ldots, x_n \rangle$ has been felicitously uttered, then, where $1 \leq i \leq n$, update the Common Ground with x_i if x_i is a set of worlds, update the To-Do List with x_i if x_i is a property and update with x_i in the appropriate way if x_i is a set of contents.

The last part is doomed to failure, even abstracting from the question of how to correctly model the update effect of disjunctions. As long as disjunction and conjunction have different update effects, the last part will not work. A set of contents could itself contain complex contents, so there are indefinitely many different procedures for updating that this last clause will need to invoke. To fill it out, the clause will have to say something like: if a member of this content set is an *n*-tuple, reapply 0.1 to it, if the member is itself a content set, reapply this clause to it. In other words, the theory must recursively compute update effects of a complex sentence on the basis of the update effects of its parts.

The inevitable need to use recursive updates that mirror syntactic structure makes it clear that the game is lost for the Static Thesis. Any empirically adequate account of how imperatives, declaratives and connectives update context must recursively compute the update effects of complex sentences on the basis of the update effects of its parts and its syntactic structure. The best explanation of this phenomenon is a dynamic semantics which assigns these dynamic effects as the semantic values of the sentences in question. The challenge here is a barrier not only to recent theories like Portner 2004 and Charlow 2014, but to the many older non-representational ones.[12] Section 4 will propose a particular way of composing updates that draws on the rich tradition of analyzing imperatives in dynamic logic.[13] Those accounts, however, prohibit mixing imperative and declarative sentences (see §3.5). My positive account shows how to interpret imperatives, declaratives and various connectives as updates on the same kind of context.

2.1.3 Dynamics of disjunction and conditional imperatives

I will now return to the issue set aside above: how disjunctions should update context. Portner 2012 makes a surprising proposal: disjunctions denote a set containing the content of each disjunct, and one simply updates context with each component of this set. So one would update a context with $!\mathsf{A} \vee !\mathsf{B}$, which denotes $\{A, B\}$, by updating the To-Do List of that context with each of these properties. Portner 2012 adds the crucial assumption that the disjuncts are always exclusive, so this update leads to a conflicted To-Do List: the addressee cannot satisfy both properties. The addressee must then choose which property to jettison. Yet, Portner 2012 does not examine disjunctions where the exclusivity is absent.

Consider a parent assigning chores to their child who utters:[14]

(21) Take out the trash or wash the dishes, or do both!

12 E.g., Hofstadter & McKinsey 1939, Castañeda 1960, Lemmon 1965, Rescher 1966, Sosa 1967, McGinn 1977, Huntley 1984, Boisvert & Ludwig 2006, Vranas 2008.

13 E.g., Meyer 1987, Segerberg 1989, 1990, van der Meyden 1996, van Eijck 2000, van Benthem & Liu 2007, Yamada 2008, Barker 2012.

14 Kai von Fintel notes that even (21) could be rendered exclusive via the process of recursive exhaustification discussed in recent work on scalar implicatures (Chierchia, Fox & Spector 2012). The first two disjuncts would be interpreted with an implicit *only*. It is enough for my argument to note that if the parent instead says *Take out the trash or wash the dishes* and the child does both, the child has not violated the command. This presents a dilemma. If equipped with recursive exhaustification, the Portner 2012 analysis predicts that the child has violated this command. But without this assumption the Portner 2012 analysis makes incorrect predictions about (21).

If the Portner 2012 analysis is directly applied to this case it wrongly predicts that (21) requires the child to both take out the trash and wash the dishes.[15] Further, if it is extended to hybrid disjunctions and pure declarative disjunctions, it predicts that the declarative components update the Common Ground. These implausible predictions highlight how difficult it is for a non-representationalist to treat disjunction.[16] The basic idea I will pursue in §4 is that disjunctions create two versions of the input context, one where each disjunct has had its update effect. It is useful to see how the Portner 2004 model could use the same idea, and say why I will pursue a different model in §4.

Portner 2004 models a context as a pair consisting of a Common Ground C (a set of propositions) and a To-Do List T (a function from individuals to sets of properties). One can instead treat contexts as a set of such pairs: $\{\langle C_1, T_1\rangle, \dots, \langle C_n, T_n\rangle\}$ — call each pair a *subcontext*. A dynamic semantics could then be specified as follows. Declaratives and imperatives operate on each C_i and T_i, respectively. Conjunction encodes sequential updates with each conjunct. Disjunction creates a subcontext for each disjunct. $\triangleright\mathsf{A} \vee \triangleright\mathsf{B}$ would take a context like $\{\langle C_1, T_1\rangle\}$ and return $\{\langle C_1 \cap a, T_1\rangle, \langle C_1 \cap b, T_1\rangle\}$. It is an important to offer an intuitive interpretation of what subcontexts are. I will do this in §3.3.2.

My positive account will drop To-Do Lists in favor of preference relations for modeling the dynamics of imperatives. I have two reasons for this change. First, To-Do Lists make it difficult to model conditional imperatives like (19) and (20). As Charlow 2010 details, there is no content one can plausibly add to a To-Do List to correctly model the effect a conditional imperative has on the permissions and requirements at play in discourse. Charlow 2010 addresses this by complicating the structure of To-Do Lists: they become functions from sets of worlds to old To-Do Lists: $\{\langle p_1, T_1\rangle, \dots, \langle p_n, T_n\rangle\}$. Intuitively, for each $\langle p_i, T_i\rangle$ the agent is supposed to make all the properties in T_i true if they are in $w \in p_i$. A conditional imperative only updates a T_i when it is associated with a p_i which entails the antecedent of the conditional. There are a number of issues for this model, but it cannot capture

15 Portner 2004, 2007, 2012 proposes that addressees are required to choose those actions which make as many of their To-Do List items true as possible.

16 Charlow (2014: §5.1) has little choice but to define disjunction in terms of conjunction and negation: $\langle S, \Lambda\rangle \vDash \phi \vee \psi \iff \langle S, \Lambda\rangle \vDash \neg(\neg\phi \wedge \neg\psi)$, where Λ is a plan (or hyper plan: see footnote 3 above). Since imperatives do not embed under negation, and it is unclear what such an embedding should mean, this semantics does not capture the imperatives scoping under disjunction discussed above.

hybrid consequents as in (20).[17] My second reason will come from the second challenge for non-representationalism, which suggests that the primary effect of imperatives is to order alternatives in the Common Ground rather than update a separate To-Do List.

2.2 Challenge 2: felicity and contextual information

The second challenge, broadly construed, is that imperatives appear to be sensitive to information or otherwise behave like information-providing discourse. Consider first the felicity of imperatives in contexts where they promote an alternative that is inconsistent with the mutual information.[18]

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

These cases indicate that the felicity of imperatives depends on the mutual information that precedes their utterance. Theories like Portner 2004 and Charlow 2014 do not have an immediate explanation of this. Portner (2004, 2007, 2012) does construct an ordering of worlds compatible with the Common Ground from the To-Do List.[19] This ordering is used to formulate a constraint on which actions rational conversationalists are expected to take: those actions make true the worlds that are best according to the ordering.[20] While the imperatives in (22) do not change this ordering, that does not violate the constraint. Furthermore, the ordering is a secondary and indirect effect of imperatives. For Portner 2004, the discourse function of imperatives is primarily to update the To-Do List and the imperatives in (22) fulfill that function flawlessly. Similarly for Charlow 2014, the imperatives in (22) denote a property of plans, and rule out plans that lack that property. Because these accounts separate To-Do Lists, or plans, and information they do not immediately capture data like (22). Further data helps highlight the takeaway point from this observation.

17 This same issue arises with the non-To-Do-List approach in Charlow 2014: §5.5.

18 Examples like (22a) and (22b) have been discussed by Kaufmann 2012: §4.2.3 in the context of a representational, modal analysis.

19 Where α is an agent and $w, w' \in \bigcap CG$: $w <_\alpha w'$ iff w instantiates a strict subset of the properties that w' instantiates from α's To-Do List.

20 For any agent α, α's actions are deemed rational and cooperative to the extent that those actions, in any world $w \in \bigcap CG$, tend to make it more likely that there is no $w' \in \bigcap CG$ such that $w <_\alpha w'$ (Portner 2004: §3.2, 2007: p. 358).

Suppose you need to do one more chore to earn your allowance and Dad gives you a choice:

(23) Take out the trash or wash the dishes!

Taking out the trash is easier, so you head for the trashcan. To your surprise, it's empty. Your brother, who's a real parent pleaser, took it out last night. It's clear that you had better get ready to wash some dishes. This means that gaining information can change what's required by an imperative: initially you were required to do either one of the chores, but after more information comes in you're required to wash the dishes. The challenge for non-representationalists is capture this information-sensitivity without assuming imperatives' function is to provide information.

The takeaway point from information sensitivity is not that it is impossible for analyses like Portner 2004 and Charlow 2014 to explain it.[21] Both accounts, at some point, appeal to an ordering of worlds from the Common Ground. I think this is a promising idea, but my analysis will not treat it as an add-on to the analysis of imperatives. Instead, I will propose that tracking the dynamics of this ordering is the core component of a semantic theory of imperatives. It meets the first challenge and explains data like (22) and (23) without further stipulations about how the Common Ground and an ordering interact. The explanation of (22), provided at the end of §3.2, relies only on the way imperatives update a preference ordering and independently justified assumptions about what rational preferences look like. The explanation of (23) will be outlined at the end of §3.3.2, and discussed more generally in §4.2 where it will be shown that $!\mathsf{T}$ is a consequence of $!\mathsf{T} \vee !\mathsf{D}, \rhd \neg \mathsf{D}$.

There is yet more to the felicity conditions of imperatives. For example, issuing contrary imperatives like (24) and (25) is infelicitous.[22] Suppose you're a Marine and your sergeant is giving you instructions to work off your demerits. Neither (24) nor (25) would be felicitous sequences for the sergeant to utter, at least without a change of mind or change of orders.

(24) a. Marine, clean that latrine!
b. #Don't clean that latrine!

21 For example the reimplementation of Charlow 2014 provided in footnote 3 could explain (22), and would likely explain (23) if equipped with an adequate account of disjunction.

22 Charlow 2014 emphasizes the importance of examples like (24) and (25), and sets out to render them inconsistent in the same way declaratives are. In §4, (24) and (25) are predicted to produce irrational preference states: even a perfectly rational decision-maker will find it impossible to satisfy them.

(25) a. Marine, if you've never been on latrine duty, clean that latrine!
b. #If you've never been on latrine duty, don't clean that latrine!

While the infelicity of these particular examples is clear, *indifference imperatives*, discussed by Davies 1986: pp. 59–60 and von Fintel & Iatridou 2017: §2, challenge the generality of these felicity conditions.[23]

(27) Go left! Go right! I don't care. (von Fintel & Iatridou 2017: §2)

But setting aside how *general* these felicity conditions are, the question stands how to explain the infelicity of (24). Representational theories have a ready explanation. The function of an imperative is to represent ways the world can be, but these pairs, taken in conjunction, rule out any way the world could be. For a non-representationalist like Portner 2004, the function of an imperative is to augment the addressee's To-Do List. This alone does not explain why updates with contrary imperatives like (24) are dysfunctional. Portner 2004 does add that the To-Do List is used to generate an ordering, which constrains which actions the addressee may rationally choose. Because of the way this ordering is constructed, a To-Do List updated with both (24a) and (24b) will generate an empty ordering and therefore fail to constrain the addressee's actions.[24] However, an empty To-Do List also has that feature and is not supposed to be dysfunctional — it's the way many conversations start. (25) compounds this issue. Even if one could explain (24) by appealing to the empty ordering it generates, that explanation will not work for (25b).

23 I suspect this is a more general discourse phenomena found across sentence types. A detective and two officers are trying to apprehend a suspect. The suspect flees, knocks the officers over and gets away. The officers are arguing about which way he went. The detective can then felicitously say:

(26) He went left. He went right. I don't care, split up and find him!

Context and intonation play a crucial role in these discourses (Davies 1986: pp. 59–60; Aikhenvald 2010: §3.1). These cues could be used in a theory where a disjunction-like discourse relation Alternation (Asher & Lascarides 2003) is inferred between sentences. This would explain why *and*, which is incompatible with Alternation, cannot be inserted between the sentences in (27) and (26). von Fintel & Iatridou 2017: §2 highlight that the same indifference interpretation is not possible in modal variants of (27). Starr (2017) argues that modal and imperative sentences encode different eventualities and that this explains why the two clause types interact differently with discourse relations. This suggests a similar explanation of why Alternation is not available for sequences of deontic modals but is available for imperatives.

24 See footnote 19 for the details on how this ordering is constructed.

On any plausible account of how (25) affects that ordering, it will not change the relative rank of worlds where the antecedent is false. In a context where there is a positive ordering of worlds in which the antecedent is false, (25) will not even lead to an empty ordering.

Charlow 2014 stresses the difficulty of explaining (24) and (25) within the Portner 2004 framework, though does not pose the specific challenge described above. As Charlow 2014: §5.6.1 also highlights, the general difficulty is one that has been articulated and discussed extensively in the philosophical literature on imperatives and expressivism. Charlow 2014: §5.3 offers a detailed explanation of (24) and (25). That explanation proceeds by showing that no planning state can, on pain of leading to a metalanguage contradiction, satisfy contrary imperatives.[25] On the account I will offer in §4, there are preference states that satisfy ('support') contrary imperatives. But those imperatives are inconsistent because the only strict preferences that support them are irrational in a practical sense: no decision maker could simultaneously satisfy them.[26] Separating these two analyses is a subtle matter left for further work.

2.3 Challenge 3: imperatives, consequence and connectives

The third challenge builds on an old one: **Ross's Paradox** concerning imperatives and disjunction (Ross 1941). I will argue that this paradox is best met semantically if one is a non-representationalist. But together with the first challenge from §2.1, non-representationalist accounts fail to meet a further challenge: treating disjunction uniformly when occurring between imperatives and declaratives. A uniform treatment is independently attractive and required to capture the hybrid disjunctions discussed in §2.1.1.

If what (28a) commands is required, is what (28b) commands required?

(28) a. Post the letter!
     b. Post the letter or burn the letter!

"No", says Ross (1941: 38). (28b) provides permission to burn the letter, which is incompatible with being required to post the letter: if you are required to

25 Charlow's (2014: §5.3) derivation neglects the absurd planning state $\varnothing$ that satisfies every sentence. This may be a problem for this strategy.

26 Earlier drafts were not sufficiently clear on this point which led Charlow 2014: §5.6.2 to criticize the analysis of §4 as predicting that there is no preference state which supports two contrary imperatives. I thank Charlow for helping me clarify this point.

post the letter, you can't burn it. This is **Ross's Paradox** (Ross 1941). It would seem that this highlights a stark contrast between disjunctions of imperatives and disjunctions of declaratives. If what (29a) says is true, then what (29b) says is true — even if saying it sounds odd (H. P. Grice 1978).

(29) a. You posted the letter.
b. You posted the letter or you burnt the letter.

However, the fact that asserting (29b) after (29a) sounds odd, and the fact that there is a plausible pragmatic explanation of this, leaves open Hare's (1967) reply: the inference in (28) is pragmatically odd, but semantically valid nonetheless. I will argue that this pragmatic reply fails if one is a non-representationalist, and that a semantic account is needed instead.

Consider first how the pragmatic explanation is supposed to work for declaratives. Asserting $\mathsf{A} \vee \mathsf{B}$ implicates that A is not known, because the latter is logically stronger and hence more informative. This Quantity implicature generates a clash when an assertion of A is followed by an assertion of $\mathsf{A} \vee \mathsf{B}$: the first represents the speaker as knowing A while the latter implicates that they do not know A. Evidence for this pragmatic analysis comes from the fact that the ignorance implication is cancelable.

(30) The prize is in the garden or the prize is in the attic. I know where it is because I hid it, but I won't tell you. (H. P. Grice 1978: p. 45)

For a non-representationalist to adopt this reply, they must fill in crucial details omitted in Hare 1967: what exactly does (28b) implicate, how does that implicature arise and why should disjunction introduction actually be valid in the first place? The second question arises since Quantity demands the speaker be as informative as possible, but the non-representationalist holds that imperatives are not in the business of providing information. Indeed, until the first question is answered, one cannot even construct an example like (30) to test the hypothesis that an implicature is involved.

It would be questionable to posit a completely different set of Maxims for imperative discourse, so the task is to find a generalization of Quantity that applies to non-representational discourse. A natural idea is this:

Generalized Quantity The speaker should be as *specific as possible*, given their conversational aims

Specificity for declaratives amounts to representing the world as accurately as possible. For imperatives, it seems natural to say that they should direct the addressee's actions as accurately as possible. While truth provides a measure of declarative accuracy, the challenge is to say what imperative accuracy is. What an imperative commands is correct just in case it is *required*. So it seems that requirement and permission are the most natural measure of imperative accuracy. But if this is right, then no semantics for imperatives and disjunction should validate disjunction introduction.

When I introduced (28), I carefully phrased it in terms of what (28a) and (28b) *require*. (28a) clearly requires the addressee to post the letter, while (28b) does not. So if good imperative inference preserves requirement (and permission), then disjunction introduction should be *invalid*. Of course, if one thinks about imperatives in terms of whether or not they are *satisfied*, the validity is more plausible. If what (28a) commands is satisfied, then what (28b) commands is satisfied. But satisfaction conditions for imperatives are not correctness or accuracy conditions. They don't say when an imperative is correct/accurate, in the way that truth-conditions say when a declarative is correct/accurate. For this reason, it is difficult to see how to fit them into a uniform understanding of what semantic values are or what Quantity is. This makes the pragmatic strategy self-undermining: the most natural way of working it out is to invoke pragmatic principles which entail that disjunction introduction is invalid for imperatives. Indeed, the considerations of the previous paragraph provide an independent argument for this: being required, and not being satisified, should play the role for imperatives that truth plays for declaratives.[27] One is left with the conclusion that disjunction introduction is simply invalid for imperatives.

To summarize, in order for a non-representationalist to adopt a Gricean account of Ross's Paradox, they must generalize maxims like Quantity. But at least on the most natural way of doing that, one is led to a semantics for imperatives that does not validate disjunction introduction anyway. In fact, just trying to find a concept for imperatives that is parallel to truth for declaratives leads one to that conclusion. This challenge seems to be implicit in the non-representationalist literature on imperatives, where there are many semantic accounts of Ross's Paradox and no modern pragmatic ones. I will now turn my attention to those accounts.

Non-representationalist accounts like Vranas 2008, Portner 2012 and Barker 2012 solve the local problem of Ross's Paradox, but generate a new problem: disjunction between declaratives is treated entirely differently from when it occurs between imperatives. For example, Portner 2012 takes imperative dis-

27 See Lemmon 1965 for related arguments to this effect.

junctions to denote a set of exclusive properties, has the To-Do List updated with both contents and then posits a pragmatic revision via the clash between the two properties. But that is not a plausible account of how disjunctions of declaratives work. Section 3.5 applies a parallel criticism to dynamic logic analyses like Barker 2012. The general problem here is this: imperatives and declaratives are treated as fundamentally different semantic types, and the 'disjunction' operation for imperatives bears little resemblance to that for declaratives. The next section outlines an analysis that meets this challenge, along with those from §§2.1 and 2.2.

3 The basic analysis

On the semantics I will propose, imperatives do not denote (refer to) a content. Instead, their meaning is identified with the characteristic way in which they change language users' mental states. Those mental states, of course, will be modeled in terms of their contents. So meanings will be functions from one content to another. I show that using the tools of dynamic semantics[28] one can assign meanings of this kind to all sentence-types and connectives in a way that meets the challenges from §2. The three sentence-types (declarative, interrogative, imperative) are semantically distinguished by the different ways they modify our mental states. Declaratives provide information and interrogatives introduce questions (alternative propositions).[29] My proposal is that **imperatives promote alternatives**.[30] In particular, *Dance Frank!* ranks Frank's dancing over Frank's not-dancing. I understand this ordering of alternatives in terms of a (binary) preference relation over a set of live alternative propositions: $\{\langle p_1, p_2\rangle, \ldots, \langle p_n, p_m\rangle\}$, meaning p_1 is preferable to p_2, and so on for the other alternatives. It is not essential to this analysis that alternatives be modeled as sets of worlds, and some may prefer to model them as properties of the addressee (Portner 2004), events or actions (Barker 2012). All that matters is that the primary effect of $!\mathsf{A}$ is to

28 For similar formulations of dynamic semantics see Veltman 1996, Groenendijk, Stokhof & Veltman 1996, Murray 2010b, 2014, Bittner 2011.

29 Stalnaker 1978 analyzed the pragmatic function of declaratives as updating information. Hamblin 1958 analyzed interrogatives in terms of introducing alternative propositions, which is compatible with the refinement that the alternatives form partitions (Groenendijk & Stokhof 1982). I will set aside interrogatives here, but see Murray & Starr (2020) and Murray (2014) for an extension of this analysis to interrogatives.

30 See Murray 2010b: Ch.8 for a similar semantics of sentential mood, and Starr 2010: Ch.4 for an earlier version of the semantics developed below.

rank an A alternative over a $\neg\mathsf{A}$ one. This makes its compositional semantics *dynamic*: it transforms one preference relation $\{\langle p_1, p_2\rangle, \ldots, \langle p_n, p_m\rangle\}$ into another $\{\langle p_1, p_2\rangle, \ldots, \langle p_n, p_m\rangle, \langle a, \overline{a}\rangle\}$.

I will begin in §3.1 by laying out this analysis in more detail, saying what body of preferences is updated by an imperative, and how declarative update can be understood in the same model. This will be enough to meet the challenge from §2.2 concerning information and felicity conditions. Section 3.3 will show how to model conjunction, disjunction and conditionals in this dynamic framework, and how it addresses the challenge from §2.1. Section 3.4 then turns to Ross's paradox and the challenges from §2.3. Throughout §3, my presentation will be semi-formal and rely heavily on diagrams. §4 provides the full formal analysis.

3.1 Simple imperatives and declaratives

Starting in familiar territory, consider Stalnaker's (1978) model of assertion. The context set c models the information conversationalists are mutually assuming for the purposes of their exchange — or *presupposing*. Formally, c is a set of worlds — those compatible with the presuppositions. Successful assertions augment this background by making more information presupposed (Stalnaker 1978). In terms of content, c comes to be restricted to a smaller set of worlds. Consider an example where there are just two basic facts of interest A (*Alice ran*) and B (*Bob ran*). Just four worlds are needed to cover every possibility; one for each Boolean combination. Fig.1 depicts the process of presupposing no information c_0 and then coming to presuppose the information carried by an assertion of A (lower-case signifies falsity). While Stalnaker 1978 took this process to be pragmatic, the kind of data discussed in §2.1 and that analyzed in Murray & Starr 2020 shows that it is better modeled as the semantic contribution of declarative mood because it compositionally interacts with connectives. This can be done in an update semantics (Veltman 1996) by having the meaning of a declarative sentence be a function from one context set to another, written $[\triangleright\mathsf{A}]$.

To extend this semantics of declarative mood to imperative mood, one must settle on what kind of structure will play the role analogous to the context set. Explaining how imperatives are used to influence action requires understanding how rational agents decide what to do. Work in decision theory, artificial intelligence and philosophy suggests understanding this process in terms of preferences: agents form preferences between alternatives and

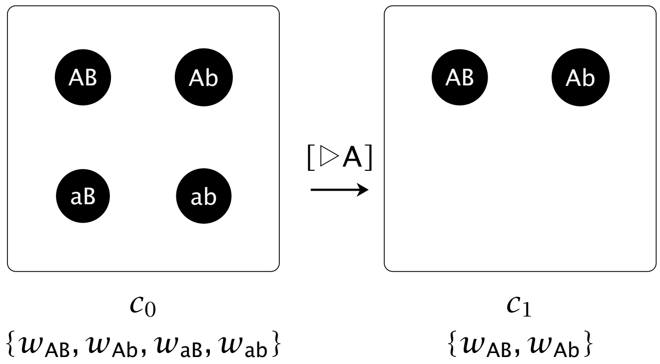


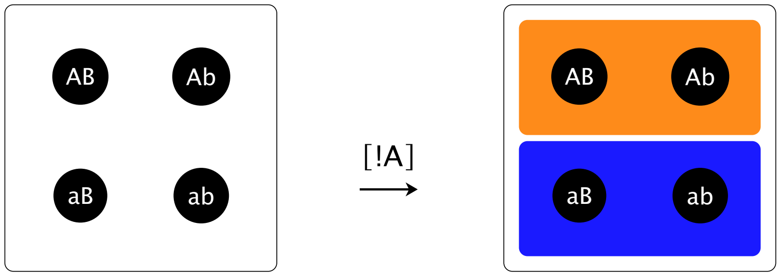
Figure 1 Declarative Update a la Stalnaker 1978

choose alternatives on this basis (Ramsey 1931, Savage 1954, Newell 1992, Hansson & Grüne-Yanoff 2011). What are alternatives? What does it mean to say that I find dancing preferable to not dancing? It at least entails that I will prefer the news that I'm dancing to the news that I'm not dancing. I will go further and *identify* preferences with a relational propositional attitude: it ranks one alternative proposition over another (Jeffrey 1990: §5.7).[31] Formally, a **preference relation** r is a set of pairs of propositions. Following Stalnaker's (1978) lead, I do not think speech acts directly affect agents' private commitments — that concerns utterance force and is a throughly pragmatic process. They effect only the agents' mutual attitudes. Imperatives, therefore, update what the agents are mutually preferring for the purposes of the exchange. For !A, this is modeled by adding a new pair of propositions $\langle a, \overline{a} \rangle$ to the existing preferences, as depicted in Fig.2.[32]

In this case, the background preferences r_0 are not substantive: they don't promote any alternative over another *live alternative*. They only prefer the world being any way to it being no way. Since imperative update amounts to unioning in a new preference, this non-substantive preference persists in r_1. The preferences in play are only assumed to cover what the agents' regard as *live possibilities*. That is essential for imperatives to be action-guiding,

31 Sometimes, preference relations relate worlds instead, e.g., van Benthem & Liu (2007). I use sets of worlds instead for a number of reasons, some of which requiring getting deep into the technicalities of the implementation. But the short version is this: it allows one to track information and preferences with one formal object by including a preference for the context set over the empty set. This is especially useful for conditional imperatives which express a preference over a restricted set of worlds.

32 Preferences are depicted with complimentary colors (orange and blue, yellow and purple, red and green), using the warm color to indicate the preferred alternative.



r_0
$\{\,\langle\{w_{\mathsf{AB}}, w_{\mathsf{Ab}}, w_{\mathsf{aB}}, w_{\mathsf{ab}}\}, \varnothing\rangle\,\}$

r_1
$\{\,\langle\{w_{\mathsf{AB}}, w_{\mathsf{Ab}}\}, \{w_{\mathsf{aB}}, w_{\mathsf{ab}}\}\rangle,$
$\langle\{w_{\mathsf{AB}}, w_{\mathsf{Ab}}, w_{\mathsf{aB}}, w_{\mathsf{ab}}\}, \varnothing\rangle\,\}$

Figure 2 Imperative Update, Warm Colors as Preferred Alternative

and also allows one to model declarative update using a preference relation, rather than separately keeping track of c. One can think of the context set c_r of a preference relation r as the union of any alternatives related by r. A declarative update $\triangleright\mathsf{B}$ to r_1 intersects each alternative with the B-worlds, thereby eliminating $\neg\mathsf{B}$-worlds from each of the alternatives in r_1. The basic semantics can be summarized as follows, and is fully formalized in §4.1.[33]

Imperative Update !A Union the input preference relation with $\{\langle a, \overline{a}\rangle\}$, where a is the set of worlds from c_r in which A is true, and $\overline{a} = c_r - a$.

Declarative Update $\triangleright$A Intersect each alternative in the input preference relation with a.

To meet the challenge from §2.2 about information and felicity conditions, one must say more about what rational preferences are.

3.2 Preference, choice and rational imperative utterances

I proposed to model imperatives using preferences because preferences relate to choice. Spelling out this connection more explicitly is crucial to understanding the proposal and explaining the challenges from §2.2. The pref-

33 On this basic semantics, formalized in Definition 4 below, the successive preferences imposed by imperatives are not combined such that $!(\mathsf{A} \wedge \mathsf{B})$ will be a consequence of $!\mathsf{A}$ and $!\mathsf{B}$. This also means that $!\mathsf{A}$ will not be inconsistent with $!(\mathsf{B} \wedge \neg\mathsf{A})$. Definition 15 addresses this issue, along with others, by providing a strengthened definition of choice, rationality, consistency, and consequence.

erences at play with imperatives are *strict preferences*, meaning that when $\langle a, \overline{a} \rangle \in r$, a is strictly preferred to $\overline{a}$. Intuitively, this means that the agents would always choose a over $\overline{a}$. There are many competing ways of formally specifying what the best choices are given a strict preference ordering. For my purposes, the most sensible one to use is a 'non-dominance principle' (Hansson & Grüne-Yanoff 2011: §3.2):

Choice a is a **good choice** in r just in case a is better than something and is not worse than anything (See Definition 11 in §4.2)

- *Notation*: $ch(r)$ is the set of good choices in r.

Given this way of thinking about choice, it becomes clear that certain preference structures are irrational in a specific sense. Preferences serve to motivate choice, just as the role of beliefs is to represent the world. Preference relations which are cyclic, like $\{\langle a, b\rangle, \langle b, a\rangle\}$, are dysfunctional because they fail to motivate any choice: there is no alternative that can be rationally chosen according to them. More formally: $ch(\{\langle a, b\rangle, \langle b, a\rangle\}) = \emptyset$. So rational preferences are ones for which $ch(r) \neq \emptyset$. What other features should rational preferences have?

The function of a preference is to motivate a choice. So preferences which leave open no choices are defective. Further, a choice which settles on an inconsistent alternative or jointly inconsistent alternatives is also a failure: you can't do the impossible, so you can't bring about inconsistent alternatives or the absurd alternative $\emptyset$. If your preferences tell you to do a and do b, but a and b are inconsistent ($a \cap b = \emptyset$), then your preferences are motivationally defective. The following definition captures this and an additional important feature:

Rational Preferences Rational preferences are those that motivate choosing some actionable alternatives in all of the foreseen circumstances, i.e., $\forall r' \subseteq r\colon\ ch(r') \neq \emptyset, \emptyset \notin ch(r')$ and $\bigcap ch(r') \neq \emptyset$.

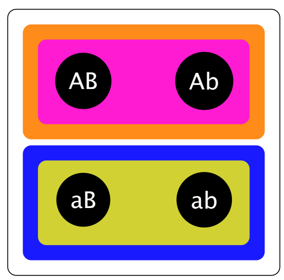
By mentioning 'foreseen circumstances' and all subsets of r, this definition prevents a preference relation like $\{\langle c, d\rangle, \langle a, b\rangle, \langle b, a\rangle\}$ from counting as rational, even though $ch(\{\langle c, d\rangle, \langle a, b\rangle, \langle b, a\rangle\}) = \{c\} \neq \emptyset$. This is not just a technical trick. An agent with such preferences will end up with cyclic preferences if they subsequently rule out the possibility of c, despite this being a foreseen possibility. That is just as irrational as having cyclic preferences in first place. There is a further technical question: what formal properties must a preference relation have to be *rational*? This is discussed in §4.2, but needn't detain us here. The two properties relevant to explaining the data from §2.2 have already been identified:

1. r is **acyclic** if and only if there is not a series $a_1, a_2, \ldots, a_n$ such that $\langle a_1', a_2' \rangle, \ldots, \langle a_n', a_1'' \rangle \in r$, where $a_1' \subseteq a_1, a_2' \subseteq a_2, \ldots, a_n' \subseteq a_n, a_1'' \subseteq a_1'$.

2. r does not promote **absurdity** if and only if $\nexists a\colon \langle \emptyset, a \rangle \in r$.

With this in place it is time to turn back to language: which *imperative utterances* are rational?

The answer is simple: rational imperative utterances are just those that lead to rational preference relations. The utterance of two contrary imperatives $!\mathsf{A}$ and $!\neg\mathsf{A}$, in state r_0, leads to an irrational preference relation. Even



$r_0[!\mathsf{A}][!\neg\mathsf{A}]$

Figure 3 Contrary Imperatives Lead to Cyclic Preferences

though $ch(r_0[!\mathsf{A}][!\neg\mathsf{A}]) = \{\{w_{\mathsf{AB}}, w_{\mathsf{Ab}}, w_{\mathsf{aB}}, w_{\mathsf{ab}}\}\}$, $r_0[!\mathsf{A}][!\neg\mathsf{A}]$ is irrational because it has a cyclic subset $\{\langle a, \overline{a} \rangle, \langle \overline{a}, a \rangle\}$. This explains the infelicity of contrary imperatives like (24) discussed in §2.2. It's not that there is no preference relation that can accept them, it's that the only one which can is irrational in a practical way: it would be defective for motivating choices. This parallels our explanations of why contrary declaratives are defective to utter, but grants the defect is not representational with imperatives. It's motivational.

Contrary imperatives do not just lead to irrational preference states in some contexts. They lead to them in all contexts. Indeed, that is how preferential inconsistency is defined:

Preferential Inconsistency

> ϕ and ψ are preferentially inconsistent just in case there is no r such that $r[\phi][\psi]$ is rational. (See Definition 14)

But some sentences can lead to irrational preference relations, and thereby be infelicitous utterances, without being *inconsistent*. That is what we find with (22a), where the infelicity stems from the contextual information.

(22) a. # Unicorns don't exist. Bring me a unicorn!

Let U: *unicorns exist* and B: *you bring me a unicorn*. There are no worlds which both lack unicorns and you manage to bring me a unicorn. So w_{uB} will not be a live possibility in the background preference relation r_{20a}. (22a) amounts to the update $r_{20a}[\triangleright\neg\mathsf{U}][!\mathsf{B}]$. The declarative eliminates both U-worlds and

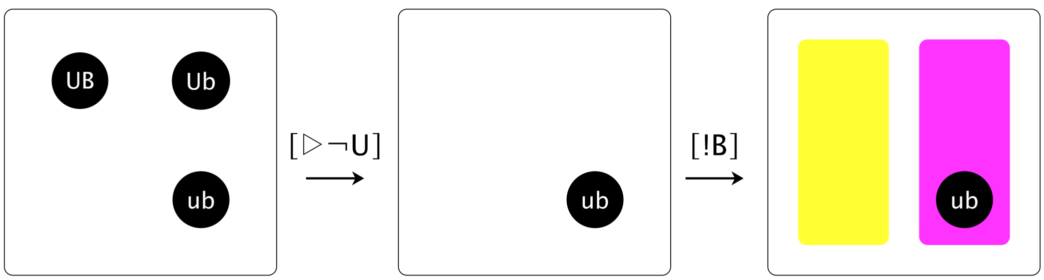


Figure 4 $r_{20a}[\triangleright\neg\mathsf{U}][!\mathsf{B}]$

thereby the only B-world. The preference introduced by !B is absurd: it promotes $\varnothing$ over the $\neg$B-worlds. This means that $r_{20a}[\triangleright\neg\mathsf{U}][!\mathsf{B}]$ is irrational, and hence an infelicitous state for the conversation to be in.

Another important piece of data was:

(22) b. # The door is open. Open the door!

(22b) can either be treated the same as (22a), or be given an alternative explanation. Suppose one had a more fine-grained analysis of alternatives that captured the fact that an imperative is supposed to involve not just a fact coming to be true, but the addressee making that fact true at some non-past time. Then in (22b), even though there are live worlds where the door is open, there are no live worlds where *you* have brought that about at the right time. Alternatively, one could point out that the second sentence will have no effect on the preference relation: it will attempts to add $\langle c_r, \varnothing\rangle$, but that preference is already there. Then the imperative fails to achieve its characteristic conversational function: to promote an alternative.[34] Further research is needed to decide between these explanations.

There was more to the challenge from §2.2: recall the infelicity of contrary conditional imperatives, and the way that disjoined imperatives, requirement and information gain interacted. Meeting these challenges, along with the embedding of mood under connectives from §2.1, requires specifying a semantics for conjunction, disjunction and conditionals.

3.3 Connectives

3.3.1 Conjunction

As is standard in dynamic semantics, conjunction will be treated as sequential update. When occurring between imperative operators, this sequences the whole imperative update. When occurring under an imperative operator,

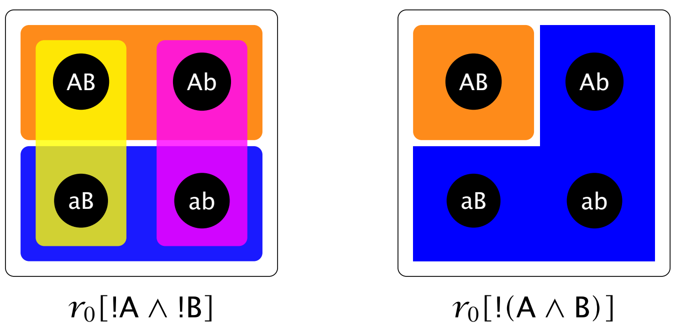


Figure 5 Conjoined Imperatives and Imperative Conjunctions

conjunction sequences the construction of the set of worlds which is used to form the preference. This difference illustrates the compositional dynamics, but does not get at a significant difference in meaning. As discussed in §3.4, on a plausible definition imperative consequence $!(\mathsf{A} \wedge \mathsf{B})$ and $!\mathsf{A} \wedge !\mathsf{B}$ will end up equivalent. Here, I wish to focus on the semantics for the connectives and how they capture embedded mood.

Conjunctions like (10) are nicely captured as sequential update.

(10) I'm going home and don't (you) try to stop me!

34 Recall that Portner (2004) and Charlow (2014) cannot adopt this kind of explanation. On their views of the conversational function of an imperative, (22b) fulfills it perfectly.

Where G is *I'm going home* and S is *You try to stop me*, (10) has the form $\triangleright\mathsf{G} \wedge !\neg\mathsf{S}$. As Figure 6 depicts, $\triangleright\mathsf{G} \wedge !\neg\mathsf{S}$ first provides information and

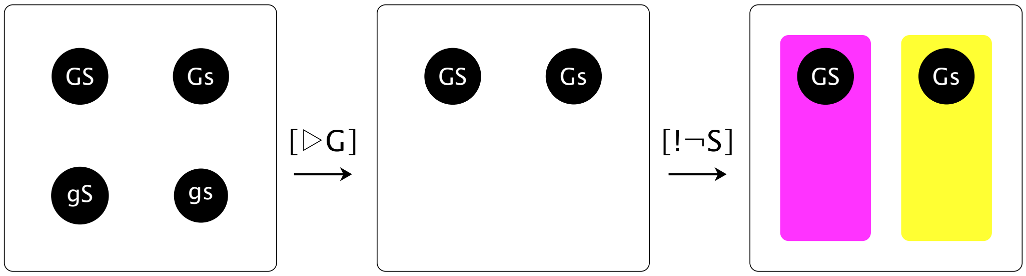


Figure 6 $r[\triangleright\mathsf{G} \wedge !\neg\mathsf{S}] = (r[\triangleright\mathsf{G}])[!\neg\mathsf{S}]$

then promotes the remaining $\neg\mathsf{S}$-worlds. Both the imperative and declarative constituents are allowed to have their distinctive effects. This effect was difficult to secure on a static analysis where connectives operate on contents and update effects are pragmatic. But as I argued in §2.1.2, the best case for the dynamic analysis comes not just from this success. It is a simultaneous and parallel success with disjunction.

3.3.2 Disjunction

Some work in dynamic semantics has treated disjunction as the union of parallel updates: $r[\phi \vee \psi] = r[\phi] \cup r[\psi]$. But recall that imperatives update by union. So this semantics for disjunction would incorrectly predict that $r[!\mathsf{A} \vee !\mathsf{B}] = r[!\mathsf{A}][!\mathsf{B}] = r[!\mathsf{A} \wedge !\mathsf{B}]$. I propose to address this problem by having sentences update *preference states* instead of preference relations:

Preference States A preference state R is a set of preference relations $r_1, \ldots, r_n$, each of which is competing for control over the agents' actions and beliefs.

Linguistically, the distinction between preference relations and preference states allows one to capture the difference between imperative conjunctions and imperative disjunctions. But, what is the general difference captured by representing an agent or context as $R_1 = \{r\}$ versus $R_2 = \{r_1, r_2\}$? In R_1, there is only one preferential and informational perspective, while in R_2 there are two. I interpret this as the agent, or agents, in R_2 being *undecided* between two preferential/informational perspectives (r_1 and r_2), while there is no such indecision in R_1. It is helpful to contrast being undecided with being uncertain.

Being uncertain whether the information in r_1 holds or the information in r_2 holds is actually *a special case* of being undecided between r_1 and r_2. You cannot decide, because you don't know which is true, and your decision hinges on the truth. This corresponds to the kind of preference state induced by $\triangleright\mathsf{A} \vee \triangleright\neg\mathsf{B}$.[35] But to interpret $R_2 = \{r_1, r_2\}$ generally as uncertainty requires a dubious move. Suppose r_1 and r_2 involve only different preferences. Then the uncertainty must be cast at a meta-level in terms of the agent being uncertain what their preferences are, or uncertain what preferences the context contains. While such states are possible, they are not an adequate way to model imperative disjunctions. In many cases, it is not natural for the addressee to follow up *Wash apples or peel bananas!* with *Okay, but which one do I have to do?* Indeed, reading *Wash apples or peel bananas!* as expressing uncertainty between two preferences would seem to undermine the presupposed authority of the speaker in many contexts. By contrast, if *Wash apples or peel bananas!* expresses an undecided preference state, one can immediately explain the fact that it allows the addressee to choose which preference relation to act on.

The utility of modeling disjunction in terms of indecision between perspectives is particularly useful for capturing the dynamic interaction between information and preferences. Consider a disjunction like $(\triangleright\mathsf{A} \wedge !\mathsf{B}) \vee (\triangleright\mathsf{C} \wedge !\mathsf{D})$. On this analysis here, this disjunction bundles together the information that A with a preference for B. This predicts that if an agent accepts this disjunction, and then the agent learns that A is false, then they can automatically dismiss the preference for B (see §4.2):

(31) a. Either I'll cut apples and you peel bananas, or I'll wash cherries and you peel dragon fruit.
b. There aren't any apples.
c. Okay, I'll wash cherries and you peel dragon fruit.

The idea that agent's learn and make decisions by maintaining multiple competing perspectives on the world has been widely developed in artificial intel-

35 Does this semantics predict a difference between $\triangleright\mathsf{A} \vee \triangleright\mathsf{B}$ and $\triangleright(\mathsf{A} \vee \mathsf{B})$? It depends on what differences one has in mind. They will be informationally equivalent, even if they produce different update effects. Further, the difference could be erased by making the declarative operator sensitive to alternatives, and giving an alternative semantics for radical disjunction.

ligence (Minsky 1985, Franklin 1995: Ch.9), epistemology and the philosophy of mind (Rayo 2013, Egan 2008, Elga & Rayo 2015).[36]

With this general framing of the proposal in place, it is appropriate to work through a concrete example. Updating a state like $R_0 = \{r_0\}$ with a disjunction will spawn two preference relations, one for each disjunct: $R_0[!\mathsf{A} \vee !\mathsf{B}] = R_0[!\mathsf{A}] \cup R_0[!\mathsf{B}]$, depicted in Fig.7. A preference *state* is rational just in case each of its preference relations is rational, in the sense defined above. This means that the rationality of a preference state is only locally enforced, and competing preference relations may disagree on which alternatives are good choices. This is reasonable given that $!\mathsf{A} \vee !\neg\mathsf{A}$ is a perfectly felicitous sentence to utter. Conjoined imperatives union preferences together into a single preference relation. But disjoined imperatives segregate them in separate preference relations and hence do not require that they be rationally coherent with each other.

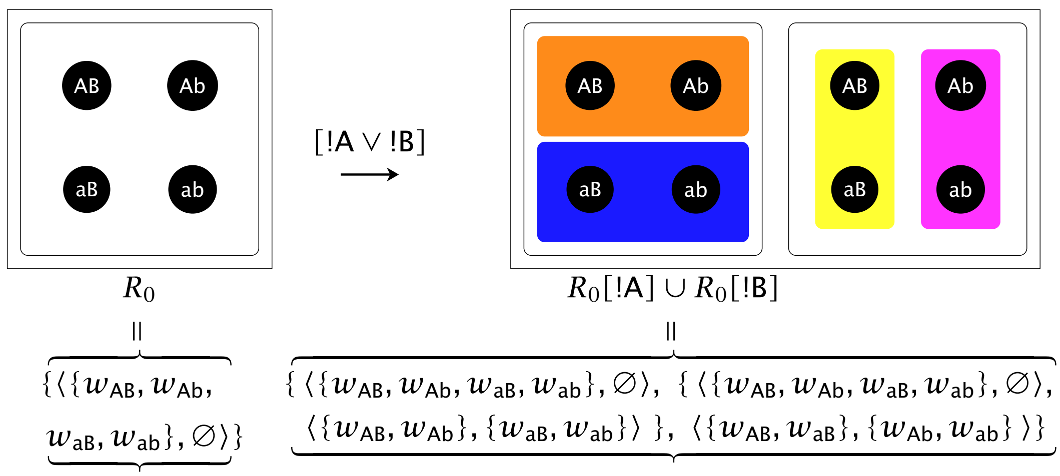


Figure 7 Updating with $!\mathsf{A} \vee !\mathsf{B}$

Preference states also capture the way in which disjunctions of imperatives are *information sensitive*. Recall example (23) *Take out the trash or wash the dishes*. The child accepts $!\mathsf{T} \vee !\mathsf{W}$, then learns the information that $\neg\mathsf{T}$, and concludes $!\mathsf{W}$. Figure 8 help illustrates why this conclusion follows

36 While it bears some resemblance to alternative (Simons 2005) and inquisitive semantics (Ciardelli, Groenendijk & Roelofsen 2013) there is an important twist here: the 'alternatives' created by disjunction are entire preference relations, and so combine preferences *and* information.

naturally from the model of rationality and preference states detailed here.

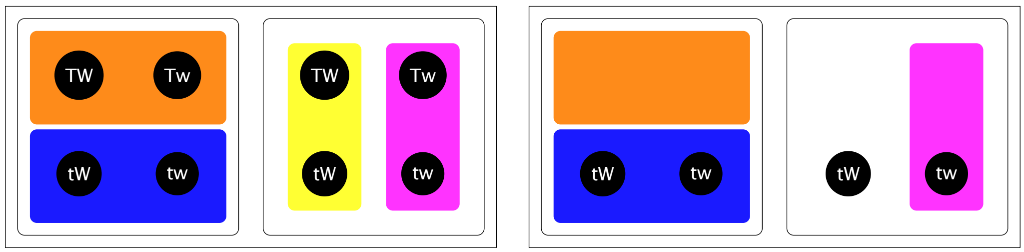


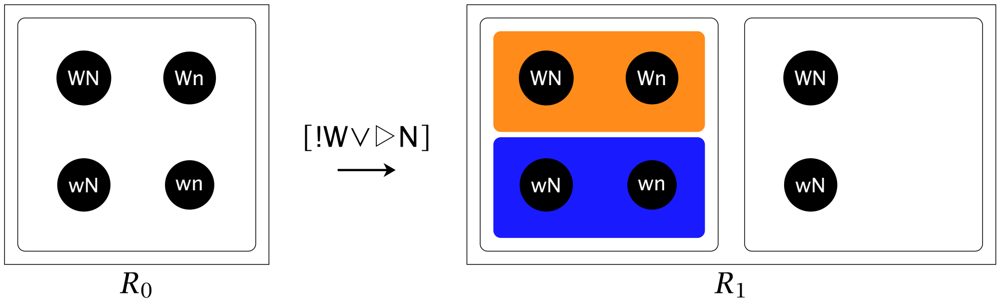
Figure 8 Updating with $!\mathsf{T} \vee !\mathsf{W}$ then information that $\neg\mathsf{T}$

The information that $\neg\mathsf{T}$ renders the preference relation for the $!\mathsf{T}$ disjunction irrational: it says the best choice is the empty set. No rational agent can stay undecided between an irrational preference relation and a rational one, so the agent moves to the state corresponding to $R_0[!\mathsf{W}]$. It bears mention that the full formal semantics for $\triangleright\mathsf{T}$ in Definition 5 (§4.1) will make this kind of reasoning automatic: $\triangleright\mathsf{T}$ will not just eliminate $\neg\mathsf{T}$-worlds, it will eliminate each pair that ends up with an absurd left element (e.g., $\langle \emptyset, q \rangle$), and eliminate a preference relation entirely if all of its pairs are eliminated. This predicts the validity of inferring $!\mathsf{B}$ from $\triangleright\mathsf{A} \vee !\mathsf{B}$ and $\triangleright\neg\mathsf{A}$.

The full power of preference states is on display with the hybrid disjunction from §2.1.

(17a) Put back *Waverly* or I'll put back *Naked Lunch*, I don't care which.

This analysis captures the fact that (17a) neither commands that you put back *Waverly*, nor asserts that I will put back *Naked Lunch*. But it also captures the fact that this utterance is not inert: it puts into competition a perspective where you are motivated to put back *Waverly* with one where I will put back *Naked Lunch*, as depicted in Figure 9. The analysis of disjunctive update in terms of preference states requires redefining all of the other sentence types for preference states. But the changes are not drastic. Declaratives and imperatives will distribute the effects they previously had to each $r_i \in R$. Conjunction can still be treated as sequential update. For details see §4.1, Definitions 4 and 5. There are interesting possibilities to consider when defining Choice for preference states, but that discussion is left for §4.2, surrounding Definition 11.



$$R_0 = \{\langle c_{R_0}, \varnothing\rangle\} \qquad R_1 = \{\langle c_{R_0}, \varnothing\rangle, \langle\{w_{\mathsf{WN}}, w_{\mathsf{Wn}}\}, \{w_{\mathsf{wN}}, w_{\mathsf{wn}}\}\rangle\}, \{\langle\{w_{\mathsf{WN}}, w_{\mathsf{wN}}\}, \varnothing\rangle\}$$

Figure 9 Updating with !W ∨ ▷N

3.3.3 Conditionals

To analyze conditionals, I will draw on recent dynamic strict conditional analyses (Veltman 2005, Gillies 2004, 2010, Starr 2014a). These analyses have two key features that make them useful here. First, they relate antecedent and consequent in terms of their updates rather than propositions, making it possible to have a general account that applies to both declarative and imperative consequents. Second, they do not assume that all conditionals have a wide-scope modal operator, making it possible to distinguish imperative operators from modals and treat hybrid imperative/declarative consequents without further assumptions. The various proposals in this family have a common element:[37]

Dynamic Strict Conditional

(if ϕ) ψ tests that updating with ψ, after updating c with ϕ, provides no more information.

- If the test is passed, then the update returns c.
- Otherwise it returns a failed information state: $\varnothing$.

37 As a reviewer highlights, this analysis does not have a straightforward account of how conditional declaratives are informative: how they eliminate worlds. Starr (2014a: §3.3) addresses this issue.

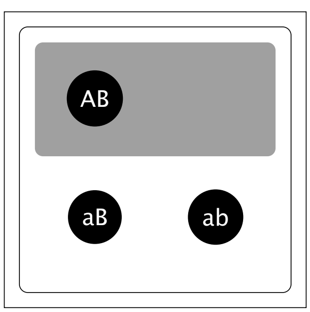
This guarantees that all of the ϕ-worlds in c are ψ-worlds. I will adapt this idea to the setting of preference states, where ψ could be declarative, imperative or a hybrid of the two.

The basic idea will be that when every preference relation in a state passes the test, then an augmented state will be returned. For declaratives, this augmented state will simply include a preference for $\phi \wedge \psi$-worlds over $\varnothing$, alongside the preference for c_R over $\varnothing$. For imperatives, this augmented state will include a preference for the $\phi \wedge \psi$-worlds over the $\phi \wedge \neg\psi$-worlds.

Dynamic Strict Conditional Generalized

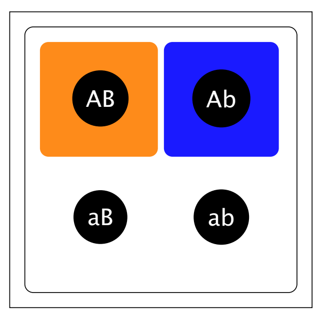
> $(\mathsf{if}\,\phi)\,\psi$ tests, for every $r \in R$, that updating with ψ, after updating $\{r\}$ with ϕ, provides no more information.
>
> - If the test is passed, then replace r with $r \cup r'$ for each $r' \in \{r\}[\phi][\psi]$.
> - Otherwise, return $\varnothing$.

Since an imperative consequent will never provide information, conditional imperatives will always pass this test. But conditional declaratives will only pass the test if all ϕ-worlds are ψ-worlds. This means that $(\mathsf{if}\,\mathsf{A}) \rhd \mathsf{B}$ will be successful only when the state contains no $\mathsf{A} \wedge \neg\mathsf{B}$-worlds. For example this update will succeed in a state $R_C = \{\{\langle\{w_{\mathsf{AB}}, w_{\mathsf{aB}}, w_{\mathsf{ab}}\}, \varnothing\rangle\}\}$. The effect



$R_C[(\mathsf{if}\,\mathsf{A}) \rhd \mathsf{B}]$

$\{\{\langle\{w_{\mathsf{AB}}, w_{\mathsf{aB}}, w_{\mathsf{ab}}\}, \varnothing\rangle, \langle\{w_{\mathsf{AB}}\}, \varnothing\rangle\}\}$



$R_0[(\mathsf{if}\,\mathsf{A})\,!\mathsf{B}]$

$\{\{\langle c_{R_0}, \varnothing\rangle, \langle\{w_{\mathsf{AB}}\}, \{w_{\mathsf{Ab}}\}\rangle\}\}$

Figure 10 Conditional Declaratives and Imperatives

of a conditional declarative is then to make the $\phi \wedge \psi$-worlds 'visible'. A conditional imperative, on the other hand, ranks $\phi \wedge \psi$-worlds over $\phi \wedge \neg\psi$-worlds — without taking a stand on $\neg\phi$-worlds.

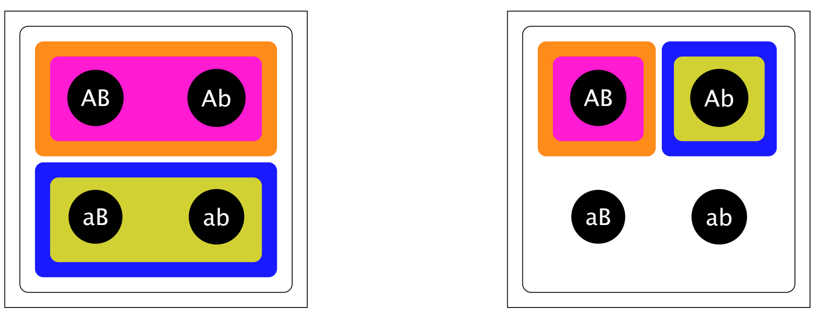
Considering these effects, it is important to say why the conditional imperative does not direct the addressee to make $\mathsf{A} \wedge \mathsf{B}$ true, instead of directing them the make B true if A holds. This comes down to the definition of Choice, and highlights something I suppressed in §3.2. Rationally choosing a over a' requires that a and a' cover all of the foreseen possibilities, i.e., $a \cup a' = c_r$. This means that the preference $\langle \{w_{\mathsf{AB}}\}, \{w_{\mathsf{Ab}}\} \rangle$ does not direct the addressee to do anything until the possibilities are restricted to the A-worlds. Similarly, the preference $\langle \{w_{\mathsf{AB}}\}, \varnothing \rangle$ induced by the conditional *declarative* does not have any directive force. For a more detailed discussion of this see Definition 11 in §4.2.

Given this analysis of conditional imperatives, one can explain the infelicity of (25) in the same way I explained the infelicity of (24) in §3.2.

(24) a. Marine, clean that latrine!
b. #Don't clean that latrine!

(25) a. Marine, if you've never been on latrine duty, clean that latrine!
b. #If you've never been on latrine duty, don't clean that latrine!

Fig. 11 makes clear that the preference relation created by the conditional imperative has a cyclic subset. As discussed in §3.2, rational preferences



R_1
$!\mathsf{A}, !\neg\mathsf{A}$

R_2
$(\mathsf{if} \rhd \mathsf{A})\, !\mathsf{B}, (\mathsf{if} \rhd \mathsf{A})\, !\neg\mathsf{B}$

Figure 11 Irrational states corresponding to (24) and (25)

cannot have these subsets. They set the agent up for failure in a circumstance they've already foreseen. So (25) is just as irrational as (24).

The flexibility of this conditional semantics is on display when the hybrid consequents from §2.1 are examined:

(20) If Chris tries to leave, I'll distract him and you close the door!

The semantics has this sentence test that worlds where Chris leaves and I don't distract him are excluded, and among the worlds where Chris leaves, adds a preference for the worlds where you close the door. Capturing this meaning without positing significant covert material or a wide-scope imperative operator makes the current analysis unique (e.g., Kaufmann & Schwager 2009, Charlow 2010). It also does not treat the conditional involved in conditional imperatives as a new kind of primitive conditional operator (*cf.* Charlow 2014).

It is important to grant that the underlying theory of conditionals assumed here is not as widely adopted as Kratzer's (1991) modal restrictor analysis. However, there are important ideas in common between the analyses and it is very much an open question, given the current literature, why one cannot capture the insights of the restrictor approach within a strict dynamic account. In light of this, the analysis of conditional imperatives in this section is not presented as a conclusively superior alternative to Kratzerian representationalist accounts like Kaufmann & Schwager 2009. Instead, it is presented as the only non-representationalist analysis currently capable of explaining data like (25) and (20). It stands a chance of being a generally competitive account of conditional imperatives, but that issue is beyond the scope of this paper.

3.4 Imperative logic and Ross's Paradox

Like other accounts (e.g., van Rooij 2000, van Benthem & Liu 2007, Yamada 2008, Portner 2012), I will model the logic of imperatives dynamically in terms of how they update an ordering of alternatives. Dynamic accounts of informational consequence hold that ψ is a consequence of $\phi_1, \ldots, \phi_n$ just in case accepting ψ after accepting $\phi_1, \ldots, \phi_n$ never changes the information being assumed (e.g., Veltman 1996). My goal in the section is to outline two forms this dynamic analysis could take and describe how they address Ross's Paradox.

One way to apply this idea to the dynamic preference semantics developed here is by focusing on *preferential consequence*:

Preferential Consequence

$$\phi_1, \ldots, \phi_n \Vdash_p \psi \iff \forall R\colon\ R[\phi_1] \cdots [\phi_n] = R[\phi_1] \cdots [\phi_n][\psi].$$

- ψ is a preferential consequence of $\phi_1, \ldots, \phi_n$ just in case accepting ψ after accepting $\phi_1, \ldots, \phi_n$ never changes the preference state.

This is the approach taken by many previous authors (e.g., van Rooij 2000, van Benthem & Liu 2007, Yamada 2008, Portner 2012). On the semantics given here, preferential consequence yields a very weak logic. While $!\mathsf{A}$ and $!\mathsf{B}$ are preferential consequences of $!\mathsf{A} \wedge !\mathsf{B}$, neither $!\mathsf{A}$, nor $!\mathsf{B}$ nor $!\mathsf{A} \wedge !\mathsf{B}$ are preferential consequences of $!(\mathsf{A} \wedge \mathsf{B})$. Fig.5 made this apparent. Updating $R_0[!\mathsf{A} \wedge !\mathsf{B}]$ with either $!\mathsf{A}$ or $!\mathsf{B}$ will have no effect. So $!\mathsf{A} \wedge !\mathsf{B} \Vdash_p !\mathsf{A}$ and $!\mathsf{A} \wedge !\mathsf{B} \Vdash_p !\mathsf{B}$. But, updating $R_0[!(\mathsf{A} \wedge \mathsf{B})]$ with $!\mathsf{A}$ will have an effect, namely to rank all of the A-worlds over all of the $\neg\mathsf{A}$-worlds. Similarly for $!\mathsf{B}$. Generally, this logic does not validate upward monotone inferences:

Upward Montonicity If $[\![\rho_1]\!] \subseteq [\![\rho_2]\!]$ then $!\rho_1 \Vdash_p !\rho_2$.

- *Counterexamples*: $!\mathsf{A} \nVdash_p !(\mathsf{A} \vee \mathsf{B}), !(\mathsf{A} \wedge \mathsf{B}) \nVdash_p !\mathsf{A}, !\neg\mathsf{A} \nVdash_p !\neg(\mathsf{A} \wedge \mathsf{B})$

This means that preferential consequence blocks the narrow scope inference in Ross's Paradox. It is not clear, however, that it is satisfactory to solve this problem by invalidating *all* upward monotonic inferences. The inference from $!(\mathsf{A} \wedge \mathsf{B})$ to $!\mathsf{A}$ is intuitively compelling: *Eat apples and bananas!* so *Eat apples!* Similarly for the inference from $!\neg\mathsf{A}$ to $!\neg(\mathsf{A} \wedge \mathsf{B})$: *Don't eat apples!* so *Don't eat apples and bananas!* I will return to this issue shortly. I will instead discuss the wide scope version of Ross's Paradox. Preferential consequence also predicts this to be invalid, an important improvement over accounts like van Rooij 2000 and Yamada 2008.

Why isn't (28b) a preferential consequence of (28a)?

(28) a. Post the letter!
b. Post the letter or burn the letter!

As Fig.12 shows, accepting the disjunction after accepting the simple imperative changes the preference state by introducing a new competing substate. Intuitively, when one moves from *Post the letter!* to *Post the letter or burn the letter!*, the second disjunct provides additional permission not granted by the premise — and so the inference does not preserve the requirement that one must post the letter. Formally, this is captured by moving from a preference state where one has to post the letter to one which is undecided between posting and burning the letter. It is important to note, however, that

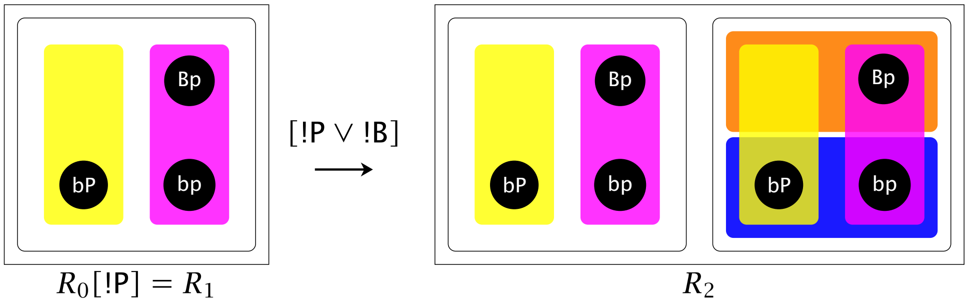


Figure 12 Disjunction Introduction is not a Preferential Consequence

the formal explanation here does not perfectly parallel the intuitive one. The inference isn't blocked because $R_0[!\mathsf{P}][!\mathsf{P} \vee !\mathsf{B}]$ permits more than $R_0[!\mathsf{P}]$, but simply because $R_0[!\mathsf{P}] \neq R_0[!\mathsf{P}][!\mathsf{P} \vee !\mathsf{B}]$. However, by relying on the concept of *Choice* from §3.2, an alternative definition of consequence is possible. It will better capture the intuitive explanation here and can be strengthened to capture upward monotonic inferences.

Choice consequence requires identity between what agents can rationally choose on the basis of the premises and what they can rationally choose on the basis of the premises together with the conclusion.

Choice Consequence

$$\phi_1, \ldots, \phi_n \Vdash_{ch} \psi \iff \forall R\colon\ Ch(R[\phi_1]\cdots[\phi_n]) = Ch(R[\phi_1]\cdots[\phi_n][\psi]).$$

- ψ is a choice consequence of $\phi_1, \ldots, \phi_n$ just in case accepting ψ after accepting $\phi_1, \ldots, \phi_n$ never changes which alternatives are good choices.
- $a \in Ch(R)$ just in case for some $r \in R\colon\ a \in ch(r)$

In other words, inferences must preserve the rational requirements from premises to conclusion. This more intuitive notion can also be easily strengthened, and intuitively evaluated, by adding constraints on rational choice. This is crucial if one wants a stronger imperative logic. For example, to validiate upward monotonic inferences one can allow that any contextual consequence of a good choice is a good choice in this stronger sense 'good choice$^+$'. Additionally, to validate the inference from $!\mathsf{A}_1 \wedge \cdots \wedge !\mathsf{A}_n$ to $!(\mathsf{A}_1 \wedge \cdots \wedge \mathsf{A}_n)$ one can allow that the intersection of any good choices is a good choice$^+$.

Strengthened Choice (See Definition 11)

1. If a is a good choice, $a' \subset c_r$ and $a \subseteq a'$, then a' is a good choice$^+$.
2. If $a_1, \ldots, a_n$ are good choices, then $a_1 \cap \cdots \cap a_n$ is a good choice$^+$ if $a_1 \cap \cdots \cap a_n \neq \varnothing$.

To be a good choice$^+$ is just to be a conjunction of one or more good choices, or a logical consequence of a good choice. If choosing to eat apples and bananas is a good choice, then choosing to eat apples is a good choice$^+$. Similarly, if choosing to eat apples is a good choice, and choosing to eat bananas is a good choice, then choosing to eat apples and bananas is a good choice$^+$ (if it's possible). By swapping Choice for Choice$^+$, one gets a definition of consequence that validates the associativity of conjunction and upward monotonic inferences. However, it still blocks the wide scope Ross's Paradox inference.

What about the narrow scope Ross's Paradox inference? Since Choice$^+$ validates all upward monotonic inferences, it will validate this one. But this is easily remedied. If one adopts an alternative semantics for disjunction and allows the imperative operator to be sensitive to these alternatives, one can require that the imperative operator create a new substate for each alternative where that alternative is preferred to its complement.[38] Since this is a formally familiar method and adds considerable complexity to the definitions, I will not explicitly implement this idea here. For more on this see the discussion following Definition 16 in §4.2.

A far more thorough discussion is necessary to settle on a logic of imperatives. However, this section has shown that there are two (or three) options, each of which can block Ross's Paradox, and one of which can retain (non-disjunctive) upward monotonic inferences under imperative operators. Crucially, the semantics for disjunction used here works exactly the same for imperatives and declaratives. While disjunction introduction is a valid informational consequence, it is not a valid preferential consequence or choice($^+$) consequence. This allows one to explain why Ross's Paradox arises in a distinctive way for imperatives. In the following section I will provide a full formalization of this approach and discuss further logical issues in a bit more detail.

38 Indeed, I did this in the 2013 version of this paper. However the added complexity obscures the basic ideas of the analysis.

3.5 Comparison: other dynamic analyses and embedded speech acts

Even prior to the full formalization presented in the next section, this analysis compares favorably to other dynamic ones. Briefly: no other dynamic analysis captures all of the hybrid sentences discussed in §2.1, no other analysis addresses the general form of Ross's Paradox discussed in §2.3, and relatively few of them capture the felicity conditions of imperatives (§2.2).

No other dynamic system clearly captures all of the hybrid sentences discussed in §2.1. Many previous dynamic analyses do not extend even to hybrid conjunctions, where imperative and declarative mood scope under *and*, because different meanings are used to conjoin imperatives and to conjoin declaratives (Barker 2012, Mastop 2011, van Benthem & Liu 2007, Yamada 2008, Žarnić 2003, van Eijck 2000, van der Meyden 1996).[39] Segerberg (1990) formulates a system of dynamic logic that allows hybrid conjunctions, and Lascarides & Asher (2003) and Asher (2007) show how to import a dynamic logic analysis into a dynamic semantics to explain hybrid conjunctions. But Lascarides & Asher (2003) and Asher (2007) do not provide a uniform analysis of disjunction in imperatives and declaratives: they use a distinct 'action disjunction' ('+') under imperative operators. As a result, this account does not extend to hybrid disjunctions.[40] Relatedly, Lascarides & Asher (2003) do not provide a way of representing, or interpreting, the hybrid conditional imperatives from §2.1.1. While Segerberg (1990) can represent those hybrid conditionals, it hinges on the controversial assumption that natural language conditionals are material conditionals.

Russell (2007) and Davis (2009) propose dynamic *semantic* variants of Portner's (2004) dynamic *pragmatic* analysis, which also makes it possible to analyze hybrid conjunctions as sequential update. But, it offers no analysis of imperative disjunctions or conditionals, let alone their hybrid cousins. In slides for a talk, Veltman (2011) outlines a more novel dynamic system that

39 Unlike Mastop (2011), the implementation of Mastop 2005: 105 gives uniform dynamic connective meanings that can be applied to both clause types, but the connectives have different meanings depending on whether they are embedded under negation. While Mastop (2005: p. 107) claims Ross's Paradox is invalid on his analysis, my attempts to apply the definitions suggest otherwise — a concern shared by Vranas (2011: 446n76).

40 For Lascarides & Asher (2003) $\triangleright \mathsf{A} \vee !\mathsf{B}$ is not ill-formed, but it is equivalent to $\triangleright \mathsf{A}$, since the declarative meaning of disjunction ignores the kinds of effects introduced by imperatives. In Segerberg's (1990) system, disjunction is not defined, but the material conditional is. Following that semantics, disjunction would be defined as: $\Gamma \vDash_x \phi \vee \psi \iff \Gamma \vDash_x \phi$ or $\Gamma \vDash_x \psi$. This semantics might hold promise for hybrid disjunctions, but it would eliminate Segerberg's (1990) attractive account of Ross's Paradox.

appears to capture both hybrid conjunctions and disjunctions. While Veltman (2011) sketches a meaning for conditional imperatives, it does not appear to capture hybrid conditionals and it is not clear that the same meaning for conditionals can be used across conditional imperatives and conditional declaratives.

As for Ross's Paradox (§2.3), none of the accounts mentioned above fully address it. Some of them invalidate the inference from $!\mathsf{A}$ to $!(\mathsf{A} \vee \mathsf{B})$ (e.g., van Benthem & Liu 2007, Yamada 2008, Žarnić 2003, van Eijck 2000, van der Meyden 1996, Segerberg 1990), but do not invalidate the equally problematic wide-scope inference from $!\mathsf{A}$ to $!\mathsf{A} \vee !\mathsf{B}$. The system outlined by Veltman (2011) does not include a definition of imperative consequence and it would not be fair to anticipate one here. It is a promising analysis that may share significant empirical coverage with that developed here.

None of these accounts fully captures the felicity conditions of imperatives (§2.2). Many of them make no connection between imperatives and contextual information, and do not attempt to say what is dysfunctional about uttering contrary imperatives (Barker 2012, Mastop 2011, Yamada 2008, Žarnić 2003, van Eijck 2000, van der Meyden 1996, Segerberg 1990). Others face the same challenge posed for Portner (2004) in §2.2 (Russell 2007, Davis 2009). Veltman's (2011) analysis tightly connects imperatives to contextual information, but it is not clear that it can explain why contrary imperatives are infelicitous. Contrary imperatives lead to an empty plan (set of to-do lists), but it is not clear what is irrational about an agent whose intentions are modeled by such a plan — it's not clear that it's practically irrational to have no intentions about what to do.

In dynamic semantics, hybrid sentence types can be analyzed because the semantics allows sub-sentential context changes and connectives to operate on context changes rather than static contents — which may differ for imperatives and declaratives. Krifka's (2001, 2014) embedded speech acts framework has similar aims, and some similar formal elements, although it has not been explicitly applied to imperatives, hybrid conjunctions, disjunctions or conditionals. Given this, it's not possible to make a direct empirical comparison with the approach developed here. But, it must be highlighted that Krifka (2001, 2014) requires that speech act force is linguistically encoded by operators in the logical form of sentences. This assumption faces a number of powerful objections which seem to show that linguistic form must under-determine speech act force (Davidson 1979, Levinson 1983, Starr 2014b). The idea that a speech act, which is an intentional act, could be embedded in a linguistic structure, which is not an intentional act, is difficult to articulate clearly. The present account avoids these issues by maintaining that only sentence force — the way a sentence updates context (Chierchia & McConnell-Ginet 2000) — is linguistically represented and semantically embedded.[41] The force of a speech act is determined by social, intentional and contextual factors outside the domain of semantics (Bach & Harnish 1979, Levinson 1983, Portner 2004, Murray & Starr 2020, 2018) — see also §5.

4 Preference semantics formalized: DLM

This section will present the analysis as a semantics for a propositional logic I call the **Dynamic Logic of Mood** (DLM). Its syntax involves radicals, which are formed from atomic sentences and boolean connectives, and sentences formed from two mood operators $\triangleright$, ! applied to those radicals.[42] Disjunctions and conjunctions are formed from two sentences, and conditionals are formed from a radical for the antecedent and a sentence for the consequent. Definition 1 achieves this by first defining radicals and then defining sentences in terms of them.

Definition 1 (DLM Syntax)

$$\begin{array}{lrl}
(1) & \alpha \in \mathscr{R}ad & \text{if } \alpha \in At = \{\mathsf{A}, \mathsf{B}, \mathsf{C}, \mathsf{D}, \ldots\} \\
(2) & \neg\rho \in \mathscr{R}ad & \text{if } \rho \in \mathscr{R}ad \\
(3) & (\rho_1 \wedge \rho_2) \in \mathscr{R}ad & \text{if } \rho_1, \rho_2 \in \mathscr{R}ad \\
(4) & (\rho_1 \vee \rho_2) \in \mathscr{R}ad & \text{if } \rho_1, \rho_2 \in \mathscr{R}ad \\
\hline
(5) & \triangleright\rho \in \mathscr{S}ent & \text{if } \rho \in \mathscr{R}ad \\
(6) & !\rho \in \mathscr{S}ent & \text{if } \rho \in \mathscr{R}ad \\
(7) & (\mathsf{if}\,\rho)\,\psi \in \mathscr{S}ent & \text{if } \rho \in \mathscr{R}ad,\ \psi \in \mathscr{S}ent \\
(8) & (\phi \wedge \psi) \in \mathscr{S}ent & \text{if } \phi, \psi \in \mathscr{S}ent \\
(9) & (\phi \vee \psi) \in \mathscr{S}ent & \text{if } \phi, \psi \in \mathscr{S}ent
\end{array}$$

It is notable here that there is no sentential negation only radical negation. On one view, natural language only contains predicate negation (Horn 1989). This would prohibit negation from scoping directly over sentential mood. Of

41 When speaking more precisely, Krifka (2014: §2.8) says that clauses denote *illocutionary act potentials*, which are functions which take a context and yield an illocutionary act. But this does not avoid the problem posed here. It still requires the clause to completely encode its illocutionary force as a function of linguistic form and context alone. Particularly since Krifka (2014: p. 66) adopts a Kaplanian model of contexts.

42 As the name suggests, DLM includes interrogatives, but they have been omitted here. See Murray & Starr (2020) for definitions.

course, English, for example, can place negation on a sentential embedding predicate like *is the case that* or *is true that*. Widescope negation could then be modeled in DLM by adding these predicates rather than allowing negation to attach to sentences. On another view, negation has the same scope possibilities as other connectives and can occur above sentential mood and expresses rejection when it does (Searle 1969: p. 32). As discussed around Definition 6 below, it would be possible to capture such a meaning in DLM. This issue about negation will be set aside for now.

4.1 DLM semantics

In a dynamic semantics, the first step is to characterize the kinds of states that sentences update. For DLM, I begin with *preference states*.

Definition 2 (Preference States, Preference Relations)

1. A **preference state** R is a set of preference relations
   - $R = \{r_0, \dots, r_n\}$
2. A **preference relation** ('substate') r is a relation on propositions
   - W is a set of 'possible worlds' each of which assigns every atomic radical to a truth-value
     - $W \colon At \mapsto \{0, 1\}$
   - $r \colon \mathscr{P}(W) \times \mathscr{P}(W)$
3. R's **context set** c_R is the union of propositions ranked by $r \in R$.
   - $c_R = \bigcup\{a \in \text{field}\, r \mid r \in R\}$, where $\text{field}\, r = \text{dom}\, r \cup \text{ran}\, r$
   - For each $r \in R$, $c_r = \bigcup \text{field}\, r$
4. The initial state **I** contains no substantive preferences or information: $\mathbf{I} := \{\, \{\langle W, \emptyset \rangle\}\, \}$

It is worth highlighting that modeling preference relations as propositional relations is crucial. If one simply used a binary strict preference relation between worlds, it would not generally be possible to use this relation to model the agent's information when they have no preferences (no two worlds are related). This should be clear from Definition 2.4, where contextual information is defined in terms of the field of the preference relation.

Furthermore, using sets of worlds allows one to distinguish between a case where an agent has an irrational strict preference $\{\langle p, \overline{p}\rangle, \langle \overline{p}, p\rangle\}$ and is indifferent between p and $\overline{p}$: $\{\langle p, \varnothing\rangle, \langle \overline{p}, \varnothing\rangle\}$. This distinction is crucial for explaining why contrary imperatives are preferentially inconsistent.

The semantics follows the syntax, where sentences are built up from radicals. A preference state update is built out of an informational update which is ultimately built from an update with an atomic radical. Atomic radicals simply eliminate worlds where they are false.

Definition 3 (Atomic Radical Semantics) For $c \subseteq W$,
$c[\alpha] = \{w \in c \mid w(\alpha) = 1\}$

Complex radicals are handled by the connective semantics in Definitions 6.1–6.3. As described in §3, an imperative $!\rho$ unions a new preference for ρ-worlds over $\neg\rho$-worlds into a preference relation. Note that this definition, applied to preference *states*, has an imperative distributing this effect to every preference relation in the incoming state.

Definition 4 (Imperative Semantics)
$R[!\square] = \{r \cup \{\langle c_r[\rho], c_r - c_r[\rho]\rangle\} \mid r \in R\}$

This ensures that a disjunction of imperatives like *Dance or sing!* followed by another imperative *Do it now!* maintains two preference relations, each where doing-it-now is preferred.

Declarative updates similarly distribute their effect to each incoming substate. $\triangleright\rho$ will filter $\neg\rho$-worlds from each incoming alternative, tosses out pairs where $\varnothing$ is ranked over something, and tosses out preference relations that thereby end up empty.

Definition 5 (Declarative Semantics)
$R[\triangleright\square] = \{r_\rho \mid r \in R \;\&\; r_\rho \neq \varnothing\}$

- $r_\rho = \{\langle a[\rho], a'[\rho]\rangle \mid \langle a, a'\rangle \in r \;\&\; a[\rho] \neq \varnothing\}$

This regimen assures that when a substate is no longer live, due to its information being ruled out, it is eliminated. After updating with $!\mathsf{A} \vee \triangleright\mathsf{B}$, updating with $\triangleright\neg\mathsf{B}$ will eliminate not just the B-worlds, but the B substate. Without this, one would predict that the agent has an irrational substate competing for control of their actions, telling them to choose $\varnothing$.

The semantics for connectives is given as follows:

Definition 6 (Connective Semantics) $\rho, \rho_1, \rho_2 \in \mathcal{R}ad$; $\phi, \psi \in Sent$

1. $c[\rho_1 \wedge \rho_2] = (c[\rho_1])[\rho_2]$
2. $c[\rho_1 \vee \rho_2] = c[\rho_1] \cup c[\rho_2]$
3. $c[\neg\rho] = c - c[\rho]$
4. $R[\phi \wedge \psi] = (R[\phi])[\psi]$
5. $R[\phi \vee \psi] = R[\phi] \cup R[\psi]$

At first glance, it may appear that conjunction and disjunction are ambiguous, depending on whether they appear in a radical or a sentence. But the connectives perform the same operations in both cases, they just operate on different kinds of sets. One can get by with just one clause for both occurrences of the connectives via quantification over types, e.g., for any X and X' that are sets of worlds or preference states: $X[\varphi] = X'$, where φ is a radical or a sentence.[43] Negation is the outlier here, and it may be useful to consider what it would do when generalized to sentential updates: $R - R[\phi]$. This operation would remove preferences added by an imperative, but will always deliver $\varnothing$ if ϕ has provided any information. This would be a 'rejection' operator.

Conditionals are not treated as binary sentential connectives, as they take a radical and a sentence, rather than two sentences. This better reflects natural languages, where conditional antecedents are subordinate clauses instead of matrix clauses. The conditional will test that the consequent carries no information after updating the input state with the information carried by the antecedent — this information is extracted in the same way that declarative mood works.[44]

Definition 7 (Conditional Semantics)

$$R[(\mathsf{if}\,\rho)\,\psi] = \left\{ \begin{array}{ll} \{r \cup r' \mid r' \in \{r\}[\triangleright\rho][\psi] \;\&\; r \in R\} & \text{if } c_{R[\triangleright\rho][\psi]} = c_{R[\triangleright\rho]} \\ \varnothing & \text{otherwise} \end{array} \right\}$$

That much is familiar from dynamic strict conditional approaches. The crucial twist here is what happens when the test is passed. Beginning in **I**, updating with $(\mathsf{if}\,\mathsf{A})\triangleright\mathsf{B}$ will union $\{\langle W, \varnothing\rangle\}$ with the one substate in $\{\,\{\langle W, \varnothing\rangle\}\,\}[\triangleright\mathsf{A}][\triangleright\mathsf{B}]$, namely $\{\langle\{w_{\mathsf{AB}}\}, \varnothing\rangle\}$, producing $\{\,\{\langle W, \varnothing\rangle, \langle\{w_{\mathsf{AB}}\}, \varnothing\rangle\}\,\}$. This does not actually change the context set of $\mathbf{I}[(\mathsf{if}\,\mathsf{A})\triangleright\mathsf{B}]$, it only brings the $\mathsf{A} \wedge \mathsf{B}$-alternative 'into view'. For a conditional like $(\mathsf{if}\,\mathsf{A})\,(\triangleright\mathsf{B} \vee \triangleright\mathsf{C})$ with a disjunctive conse-

43 This can be accomplished using polymorphic type theory (e.g., Milner 1978).

44 If you dislike the insertion of '$\triangleright$' simply replace it with the set-theoretic specification of declarative update in Definition 5.

quent, updating **I** will produce an output state with two substates:

$$\{\,\{\langle W,\varnothing\rangle,\langle\{w_{\mathsf{ABC}},w_{\mathsf{ABc}}\},\varnothing\rangle\},\{\langle W,\varnothing\rangle,\langle\{w_{\mathsf{ABC}},w_{\mathsf{AbC}}\},\varnothing\rangle\}\,\}$$

Updating **I** with $(\mathsf{if}\,\mathsf{A})\,!\mathsf{B}$ will lead to $\{\,\{\langle W,\varnothing\rangle,\langle\{w_{\mathsf{AB}}\},\{w_{\mathsf{Ab}}\}\rangle\}\,\}$. This effect always occurs because the consequent never provides any information. If the information that A is subsequently added to the state, it will produce the state $\{\,\{\langle\{w_{\mathsf{AB}},w_{\mathsf{Ab}}\},\varnothing\rangle,\langle\{w_{\mathsf{AB}}\},\{w_{\mathsf{Ab}}\}\rangle\}\,\}$. In that state, the only good choice available is $\{w_{\mathsf{AB}}\}$. While $\{w_{\mathsf{AB}},w_{\mathsf{Ab}}\}$ is not dispreferred, it is entailed by something that is, namely $\{w_{\mathsf{Ab}}\}$. As Definition 11 below makes precise, being entailed by something dispreferred is enough to discount an alternative.

4.2 Consequence and consistency

To investigate the logic that arises from the semantics above, one must settle on definitions of consequence. I cannot aspire to consider all of the options here, but will highlight the most familiar definitions and a few of the alternatives that bear on the data discussed in this paper. Beginning with informational consequence, it is analyzed as an informational fixed point, as is familiar in dynamic semantics.

Definition 8 (Informational Consequence)

- $\phi_1,\ldots,\phi_n \vDash \psi \iff \forall R\colon\ c_{R[\phi_1]\cdots[\phi_n]} = c_{R[\phi_1]\cdots[\phi_n][\psi]}$.
  - ψ is an informational consequence of $\phi_1,\ldots,\phi_n$ just in case accepting ψ after accepting $\phi_1,\ldots,\phi_n$ never changes the contextual information.

This captures the main function of declarative sentences, but misses the effects on preference states induced by imperatives. This suggests a more comprehensive definition of consequence that requires identity not just of information, but of preference state.

Definition 9 (Preferential Consequence)

- $\phi_1,\ldots,\phi_n \Vdash_p \psi \iff \forall R\colon\ R[\phi_1]\cdots[\phi_n] = R[\phi_1]\cdots[\phi_n][\psi]$.
  - ψ is a preferential consequence of $\phi_1,\ldots,\phi_n$ just in case accepting ψ after accepting $\phi_1,\ldots,\phi_n$ never changes the preference state.

Table 1 summarizes some notable results of this definition. As noted in

Consequences	Non-Consequences
$!\rho \Vdash_p !\rho$	$!\rho_1 \nVdash_p !\rho_1 \vee !\rho_2$
$!\rho_1 \wedge !\rho_2 \Vdash_p !\rho_{1/2}$	$!\rho_1 \nVdash_p \rhd\rho_1$
$(\mathsf{if}\,\rho_1)\,!\rho_2, \rhd\rho_1 \Vdash_p !\rho_2$	$!\neg\rho_1, (\mathsf{if}\,\rho_1)\,!\rho_2, \rhd\rho_1 \nVdash_p !\neg\rho_1 \wedge !\rho_2$
$!\rho_1 \vee !\rho_2, \rhd\neg\rho_{1/2} \Vdash_p !\rho_{2/1}$	$!\rho_1 \wedge !\rho_2 \nVdash_p !\rho_1 \vee !\rho_2$
	$!(\rho_1 \wedge \rho_2) \nVdash_p !\rho_{1/2}$
	$!\neg\rho_1 \nVdash_p !\neg(\rho_1 \wedge \rho_2)$
	$!\rho_1 \nVdash_p !(\rho_1 \vee \rho_2)$

Table 1 Notable Features of Preferential Consequence

§3.4, the last three non-consequences are instances of a more general pattern: the imperative operator is not upward monotonic, when preferential consequence is assumed. While the disjunctive non-consequence is plausible, the other Boolean instances are less plausible.[45] It is possible to remedy this by defining consequence in terms of choice. Since choice is also central for understanding consistency I will turn first to defining choice and consistency, and then return to defining choice consequence and upward monotonicity.

As discussed in §3.2, the alternatives which are good choices with respect to a preference relation are the non-dominated ones. This definition begins by defining the *promoted alternatives* — a concept I've informally used throughout — which will be a superset of the alternatives that are good choices.

Definition 10 (Promoted Alternatives, $P(r)$)
$P(r) := \{a \mid \exists a' \colon \langle a, a' \rangle \in R \ \&\ a \cup a' = c_r\}$

- a is promoted in r just in case it is preferred to something, and this preference bears on all of the live possibilities.

This definition rules out alternatives preferred only in the consequent of a conditional. Those alternatives are only preferred in a subset of the live possibilities, and so do not directly influence which alternatives should be

45 Though see Segerberg (1990) and Jackson (1985) for attempts to argue that $!A$ is not an intuitive consequence of $!(A \wedge B)$.

chosen in general. Choice can then be defined in terms of non-dominance among promoted alternatives.

Definition 11 (Non-dominated Choice, *ch*)
$ch(r) = \{a \in P(r) \mid \nexists a_1 \in P(r), a_2 \colon \langle a_1, a_2 \rangle \in r \;\&\; a \subseteq a_2\}$

- a is a **good** choice in r just in case:
    i. a is a promoted alternative
    ii. No promoted alternative is preferred to a or to some alternative that a entails.

Clause (ii) prohibits a being dispreferred and a entailing anything which is dispreferred. This is relevant for intuitively inconsistent examples like $!\mathsf{A}$ and $!(\mathsf{B} \wedge \neg\mathsf{A})$ where the second imperative does not make the A-alternative dispreferred, but does make dispreferred the $\neg\mathsf{B} \vee \mathsf{A}$-alternative which is entailed by the A-alternative. Clause (ii) is also limited to promoted alternatives so that conditional preferences cannot rule out an alternative.

Recall that the main utility of defining Choice, is to permit a definition of which preference relations are rational.

Definition 12 (Rational Preferences) Rational preferences are those that motivate choosing actionable alternatives in all of the foreseen circumstances, i.e., $\forall r' \subseteq r \colon \; ch(r') \neq \emptyset, \emptyset \notin ch(r')$ and $\bigcap ch(r') \neq \emptyset$.

The motivations of this definition were discussed extensively in §3.2. Here I just note that Fact 1 follows from Definitions 11 and 12.[46]

Fact 1 (Acyclicity and No Absurdity) If r is rational, then r is acyclic and non-absurd.

A full investigation of the necessary and sufficient properties of rational preference relations will have to wait for another occasion.

The definition of rational relations can be generalized to *states*:

Definition 13 (Rational Preference States) A preference state R is rational just in case each $r \in R$ is rational, in the sense of Definition 12.

46 This is a small, obvious generalization of the fact that a function based on Non-dominance is a choice function if and only if it is acyclic (there, choice functions, by definition, return non-empty alternative sets) (Hansson & Grüne-Yanoff 2011: §3.2)

This does not make a global requirement of inter-preference relation coherence. This is motivated by the idea that these preference relations are distinct competing states that likely offer very different motivational perspectives. They form a different kind of ecology than the individual preferences that inhabit preference relations. This allows one to say when particular utterances lead to an irrational preference state, and also allows one to say when some sentences are preferentially inconsistent:

Definition 14 (Preferential Consistency)

- $\phi_1, \ldots, \phi_n$ are preferentially consistent just in case $\exists R\colon\ R[\phi_1] \cdots [\phi_n]$ is rational, in the sense of Definition 13.

This definition predicts not just that $!\mathsf{A}$ and $!\neg\mathsf{A}$ are inconsistent, but also that $!\mathsf{A}$ and $\triangleright\neg\mathsf{A}$ are inconsistent. This versatility is in keeping with the focus on hybrid sentence-types here.

An alternative logic of imperatives arises by defining consequence (and rationality/consistency) not just in terms of choice, but a slightly strengthened version of choice:

Definition 15 (Choice$^+$)

i. $$ch^+(r) := \{a' \subset c_r \mid a \in ch(r)\ \&\ a \subseteq a'\} \cup \{a \mid \exists X \in \mathscr{P}(ch(r)) - \varnothing\colon\ a = \textstyle\bigcap X\}$$

ii. $Ch^+(R) := \{a \mid \exists r \in R\colon\ a \in ch^+(r)\}$

This means that logical consequences of good choices are good choices$^+$, as well as arbitrary conjunctions of good choices.

Choice$^+$ consequence is defined as preserving good choices$^+$.

Definition 16 (Choice$^+$ Consequence)
$\phi_1, \ldots, \phi_n \Vdash_{Ch^+} \psi \iff \forall R\colon\ Ch^+(R[\phi_1] \cdots [\phi_n]) = Ch^+(R[\phi_1] \cdots [\phi_n][\psi])$.

- ψ is a choice$^+$ consequence of $\phi_1, \ldots, \phi_n$ just in case accepting ψ after accepting $\phi_1, \ldots, \phi_n$ never changes which alternatives are good choices$^+$.

After updating with $!(\mathsf{A} \wedge \mathsf{B})$, the $\mathsf{A} \wedge \mathsf{B}$-alternative will be a good choice$^+$ (if anything is). But since the A-alternative is a consequence of this good choice, it will be a good choice$^+$. So updating this state with !A will not change the good choices$^+$. Similarly for the other upward monotonic patterns. To block only the inference from !A to !(A $\vee$ B), one could offer an alternative semantics for radicals where they update sets of propositions, rather than propositions. C[A $\vee$ B] would produce the set consisting of the set of all A-worlds and the set of all B-worlds. The imperative operator could then be defined so as to produce a substate for each alternative where that alternative is ranked over its negation. This would render !A $\vee$!B and !(A $\vee$ B) equivalent.

Choice$^+$ consequence maintains all of the consequences of preferential consequence: if $R[\phi_1]\cdots[\phi_n] = R[\phi_1]\cdots[\phi_n][\psi]$ then $Ch^+(R[\phi_1]\cdots[\phi_n]) = Ch^+(R[\phi_1]\cdots[\phi_n][\psi])$, since Ch^+ is a function. As noted, it permits upward monotonic inferences under the imperative operator. A further comparison, particularly with respect to conditional imperatives, will have to wait for another occasion.

A final logical issue is worth noting: !(A $\wedge$ B) is not a preferential consequence of !A $\wedge$!B. The simple reason is that !A $\wedge$!B does not ensure that there is a A $\wedge$ B-alternative. However, it is a choice$^+$ consequence since the A $\wedge$ B-alternative is the intersection of the two alternatives promoted by !A $\wedge$!B. This is a limited form of downward monotonic closure. It does not seem plausible to validate all downward monotonic patterns since !(A $\wedge$ B) does not intuitively follow from !A: *Eat apples!* so *Eat apples and bananas!*

5 The open end

To conclude, it is helpful to compare the analysis briefly to representationalist ones and discuss how it may speak to issues that have been central in that literature. I focus on the modal analysis of Kaufmann 2012 and the issue of illocutionary heterogeneity, as those have become central to recent discussions of imperatives in linguistics.

5.1 The modal analysis

On Kaufmann's (2012: 60) approach, *Leave!* denotes the same proposition as *You should leave!*, though they have different syntactic structures/logical forms. *Should* and its imperative analog, call it [!], are analyzed as necessity modals using Kratzer's (1981, 1991) framework. Modal sentences are assigned propositions relative to a contextually supplied modal base f — providing a domain of worlds — and ordering source g — providing a ranking of the domain. Necessity modals universally quantify over the g-best worlds from the f-domain. However, $[!]$ is a special kind of necessity modal that lexically enforces a suite of presuppositions that limit the felicitous use of $[!]\phi$ to contexts where it will have a *performative use*. The basic idea is that the speaker must be sufficiently authoritative and uncertain about the world such that when they utter $[!]\phi$ the conversation automatically accommodates the f and g needed to make the proposition expressed by $[!]\phi$ true. In a way, this analysis is not so different than that proposed here. In my analysis, the role of f is played by c_R and the role of g is played by the orderings of alternatives. Further, the two analyses agree that the key effect of imperatives is to change an ordering. The differences come in how this ordering is changed. If these two very similar analyses are to be separated, it must be on the basis of this difference.

One cost of Kaufmann's (2012) analysis is that it must stipulate what the theory in §3 explains on more general grounds. Kaufmann 2012: p. 157 must stipulate that $!\mathsf{A}$ presupposes there are live A-worlds and $\neg\mathsf{A}$-worlds, because that is a precondition of a performative use. This effectively stipulates data like (22).

(22) a. # Unicorns don't exist. Bring me a unicorn!
b. # The door is open. Open the door!

By analyzing the semantics of imperatives directly in terms of how they update an ordering, (22) can be explained on more general grounds (§3.2).

Another cost of Kaufmann's (2012) analysis surfaces with imperatives that scope under disjunction. With $[!]\mathsf{W} \vee \triangleright\mathsf{N}$ or even $[!]\mathsf{W} \vee [!]\mathsf{N}$, the minimal accommodation needed to make the whole utterance true is to make one disjunct true. And yet, this is not what these sentences are used to communicate, and clearly does not capture the perspective of a hearer who accepts them. To do that, one needs an account of the sub-sentential effect each sentence has, and to compute the total effect from how disjunction combines these two effects. However, by deriving the effect on an ordering via accommodation, a modal analysis is forced to treat the effect of a disjunction globally. This speaks in favor of treating imperatives as dynamically updating an ordering without invoking a proposition.

These two objections can really only be weighed against the positive evidence for the modal analysis: the evidence that a modal proposition is involved in the meaning of an imperative. The fact that imperatives can be used to resolve questions has been proposed as evidence of this kind: imperatives can resolve questions which the modal proposition would directly answer (Kaufmann 2012: §2.3.3).

(32) a. *X*: Which bus should I take?
b. *Y*: Take the number 10 bus.
c. (*Y*: You should take the number 10 bus.)

(32b) and (32c) seem to be equally good ways to resolve the question. (32b) achieves this with a modal proposition, but what can one say about (32b) if one is a non-representationalist? Here, it is important to distinguish between the act of *directly answering* a question — asserting one of the semantic answers — and the more general act of *resolving* a question — doing something which achieves the goals of the speaker which motivated their question. For example, both (33b) and (34b) resolve questions without directly answering them.

(33) a. *X*: How do you open this drink?
b. *Y*: [*Twists the lid of X's drink*]

(34) a. *X*: Do you speak English?
b. *Y*: How may I assist you?

The analysis proposed above makes it is possible to analyze (32b) as resolving the question posed by (32a) without directly answering it.

The conversational goal of the imagined question in (32a) is to help the speaker decide which bus to take. An authoritative utterance of (32b) will lead *X* to prefer worlds in which they take bus 10 over worlds in which they don't. Any rational agent like this can be expected to thereby choose to take bus 10. So an utterance of (32b) will achieve the conversational goal that motivated the question (32a).[47] In this case, the similarity between a modal analysis and the dynamic analysis propose here is on full display. As discussed above, it is only by investigating rather subtle features of how imperatives affect an ordering that it is possible to separate the analyses.

Being a non-representationalist makes the data discussed in §2 difficult where a modal analysis makes it easy. If it had not been possible to meet the challenges posed by that data within a non-representationalist framework, I too would be compelled to embrace something like the modal analysis. However, I hope to have shown that there is at least another choice.[48]

47 It is also worth noting that (32c) is a dynamic consequence of (32b), so the sense in which (32b) resolves (32a) is even tighter than the resolutions in (33) and (34).

48 See Starr 2016a,b for an approach to deontic modality that locates it on a spectrum between imperatives and declaratives.

5.2 Illocutionary heterogeneity

Imperatives typically serve a directive function, but often don't.

(35)
a. Try the felafel! — *Suggestion*
b. Win a cruise to Jamaica! — *Advertisement*
c. Have a nice day!/Drop dead! — *Wish/Curse*
d. Be a blonde!/Rain! — *Stative/Eventive Wish*
e. Sit down! — *Command*

This heterogeneity has been emphasized in work on imperatives, especially among representationalists like Kaufmann 2012 and Condoravdi & Lauer 2012. While imperatives have an impressively wide range of uses, I believe it is a mistake to assume that it is a phenomenon specific to imperatives. Unlike Kaufmann 2012 and Condoravdi & Lauer 2012, I would seek to explain illocutionary variation within a general framework that applies equally to declaratives, interrogatives and imperatives. Such a framework has been proposed in Murray & Starr 2020, 2018, and is built on top of the semantics for mood proposed here.

Following Chierchia & McConnell-Ginet (2000), Murray & Starr 2020 and Murray & Starr 2018 distinguish **sentential force** — how a sentence type semantically updates the mutual assumptions of a conversation — and **utterance force** — how a concrete utterance coordinates the commitments of the conversationalists. On this approach, the variety found in (35) is purely variation in the force of imperative *utterances*. Murray & Starr 2020 and Murray & Starr 2018 detail how either a standard Neo-Gricean approach, or an approach centered on social norms, can explain variations in utterance force like those above while maintaining a semantic account of sentential force.

5.3 Conclusion

It is hard to formulate an adequate non-representational theory of imperatives. The challenges from §2 emphasized this, showing that imperatives integrate with representational language and connectives more than previously appreciated. But the analysis from §§3 and 4 shows it is possible to formulate a non-representational account that meets these challenges. The key is to embrace a more general, dynamic conception of meaning that provides a common format for connectives, imperatives and declaratives. Imperatives promote alternatives, declaratives provide information, conjunction sequences update effects and disjunction divides update effects between competing substates.

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