Conjoining imperatives and declaratives[1]

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Abstract. This paper investigates conjoined imperatives and declaratives (IaDs). It argues that some IaDs are best explained in terms of true conjunction and anaphora between conjuncts, despite challenges posed by von Fintel and Iatridou (2017). The key to addressing these challenges is a dynamic, non-modal analysis of imperatives building on Starr (to appear). The other IaDs are explained by appeal to a semantically related use of *and*, e.g. 'left-subordinating *and* ($_{LS}and$)' (Culicover and Jackendoff 1997). These other IaDs neutralize the directive meaning of the imperative, and this paper offers a new account of this building on 'parameter-change conjunction' (Klinedinst and Rothschild 2012). New data is presented that helps distinguish between the varieties of IaD, and it is shown that the proposed analysis captures it.

Keywords: Conjunction, imperatives, dynamic semantics, anaphora, discourse relations

1. Dividing IaDs and the von Fintel and Iatridou (2017) challenge

Imperative meaning bears on deep theoretical questions about the nature of meaning, especially given standard commitments inherited from the logical tradition that informs contemporary formal semantics. As Frege (1923) comments, and Dummett (1973: Ch.10) later detailed, truly conjoined imperatives and declaratives do not fit with the standard assumptions of formal semantics where all meaning, especially the meaning of connectives, is purely truth-conditional — at least not without assimilating imperatives and declaratives. Dummett (1973: Ch.10) argues that English does not permit such a construction, and that all attempts result in 'non-compositional conditional meanings'. Philosophers now have the benefit of an extensive, sophisticated empirical literature on these constructions.[2] I will draw on the insights of this literature and new data to argue against Frege (1923) and Dummett (1973: Ch.10): natural languages contain truly conjoined imperatives and declaratives, and conditional meanings arise in a principled, compositional manner that is not specific to imperatives. The catch is that one must adopt a dynamic semantics that departs from the assumption that connectives have only truth-conditional meaning.

As a preliminary, it is important to observe that while the compositional issues surrounding classic IaDs like (1) are unresolved, it is a mistake to draw any general conclusion about these issues just from IaDs. As argued by Starr (to appear), conjunctions with the opposite order like (2) establish that imperatives and declaratives compositionally combine via true conjunction.

(1)   Make tortillas and I'll serve them.

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

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[2] E.g. Bolinger (1979); van der Auwera (1986); Clark (1993); Lascarides and Asher (2003); Txurruka (2003); Franke (2005); Russell (2007); Asher (2007); Franke (2008); Scontras and Gibson (2011); Kaufmann (2012); Keshet (2013); von Fintel and Iatridou (2017), among others.

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Examples like (2) are strong evidence against Dummett's (1973: Ch.10) hypothesis — more recently entertained by Franke (2005) and von Fintel and Iatridou (2017) — that *all* conjunctions of imperatives and declaratives involve a special conditional meaning of *and*.[3]

The literature now recognizes three kinds of IaDs, exemplified by (3a)-(5a).[4]

(3)   a.   Make tortillas and I'll make chile.   (endorsed-IaD)

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

(4)   a.   Screw up the tortillas and I'll rub a chile in your eye.   (not endorsed-IaD)

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

(5)   a.   Make tortillas and you'll need flour.   (not endorsed-IaD)

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

(3b)-(5b) are my own contribution to the literature. Previously, examples like (3a) have been described as endorsing the directive conveyed by the imperative conjunct, and so called e-IaDs. Examples like (4a) and (5a) were described as not endorsing the imperative conjunct, and so called n-IaDs. Further, it was noted that examples like (4a) convey a negative evaluation of following the imperative while examples like (5a) present the imperative neutrally. These semi-theoretical descriptions have not been accompanied by a clear empirical diagnostic. While Culicover and Jackendoff (1997) and Kaufmann (2012) observe that *please* can felicitously (and non-sarcastically) occur in examples like (3a) but not in examples like (4a) and (5a), this does little to explain the contrast between (4a) and (5a). I propose that the follow-ups in (3b), (4b) and (5b) can provide just such an empirical diagnostic.

The fact that there is a felicitous way of following up the imperative conjunct with its contrary in (4b) and (5b) shows that the imperative conjunct cannot have directive force. Similarly, the infelicity in (3b) shows that the imperative conjunct does have directive force. Further, the difference between the felicity of *but* and *so* in (4b) and (5b) shows that the non-endorsement of the imperative conjunct is different. The undesirable state of affairs brought about by following the imperative in (4a) invites the inference that the contrary directive should be followed — hence *so* in (4b). The unavailability of *but* follows naturally from this: since the contrary directive (*Don't screw up the tortillas*) follows from what (4a) says in context, its issuance does not contrast with expectations in the way that *but* requires. For (5a), the imperative appears to neutrally introduce the prospect of an action, making it infelicitous to claim with *so* that the contrary imperative follows. It is, however, felicitous to contrast the contrary imperative using *but* since the directive meaning of (5a)'s imperative does not escape the conjunction.

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[3]This hypothesis also makes it more awkward to explain the syntactic findings of Scontras and Gibson (2011) which indicate that there are systematic syntactic differences between Type I and Type II IaDs.

[4]See especially Clark (1993), Russell (2007) and von Fintel and Iatridou (2017).

Given these empirical diagnostics and the explanations they suggest, the overall shape of Kaufmann's (2012: Ch.6) divided analysis seems appealing:

Divided Analysis
1. Type I IaDs like (3a) involve true conjunctions that allow the directive meaning to emerge, and the second conjunct's modal is contextually restricted to worlds where the imperative has been followed.
2. Type II IaDs like (4a) and (5a) involve a semantically distinct connective $_{LS}and$ (Culicover and Jackendoff 1997) which effectively traps the imperative meaning in the antecedent of a conditional.

The appeal of a Divided Analysis is strengthened by a recent study which finds systematic syntactic differences between Type I and Type II IaDs (Scontras and Gibson 2011). The conditional, non-directive meaning of Type II IaDs can be explained in terms of $_{LS}and$ (Culicover and Jackendoff 1997; Klinedinst and Rothschild 2012), the scope-based analysis of modals and conjunction called *conditional conjunction* (Keshet 2013) or an approach based on a conditional discourse relation being associated with *and* in particular syntactic environments and discourse contexts (Lascarides and Asher 2003). For Type I IaDs, the question is how exactly the modal *will* in the second conjunct is restricted to worlds where the imperative has been followed. Kaufmann (2012: Ch.6) and Lascarides and Asher (2003) treat it as a kind of modal subordination, as in *You should make tortillas and I'll make chile*. Here, the speaker only commits to making chile *if* the addressee makes tortillas. The second modal is interpreted in a way that is subordinated to the first: it is restricted to worlds where the prejacent of the first modal is true. But this appealing approach faces an important problem raised by von Fintel and Iatridou (2017: §3.1): Type I IaDs are felicitous where explicit modal subordination is not. This, of course, throws into doubt the attempt to derive the conditional meaning of Type I IaDs through modal subordination.

Modal subordination is the general phenomenon by which one modal is taken to be restricted to worlds where the prejacent of an earlier modal holds (Roberts 1989). For example, the modal *would* in (6a) is taken to be restricted to worlds where a wolf has wandered in, rendering (6a) and (6b) equivalent.

(6)   a.   A wolf might wander in. It would eat you.
         b.   If a wolf wanders in, it would eat you.

Von Fintel and Iatridou (2017: §3.1) observe that while (7a) is felicitous, an exactly parallel explicit case of modal subordination is not felicitous in (7b).

(7)   a.   Invest in this company and you will become rich.
         b.   #You must invest in this company and you will become rich.

As they note, the infelicity of (7b) could be explained by the general fact that conjunction prohibits the right conjunct from explaining the left (Txurruka 2003):

(8)   a.   Gabe is not allowed in the tent. He will get it dirty.
       b.   #Gabe is not allowed in the tent and he will get it dirty.

Von Fintel and Iatridou (2017: §3.1) rightly observe that this only explains why (7b) is infelicitous, not why (7a) is felicitous. Further, von Fintel and Iatridou (2017) challenge a modal subordination analysis to explain the contrast in (9a) and (9c).

(9)   a.   Don't park there! You'll be towed.
       b.   = Don't park there! If you park there, you'll be towed.
       c.   ≠ Don't park there and you'll be towed.

The puzzle is that if modal subordination allows (9a) to be interpreted as (9b), and Type I IaDs like (9c) involve modal subordination, then why doesn't that modal subordination allow the same 'polarity switched' interpretation? Fortunately for the Divided Analysis, I believe these puzzles can be answered. However, it requires abandoning the idea that imperatives are modals, appealing to a more general mechanism of modal anaphora rather than the specific mechanism of modal subordination and investigating the discourse relations that support modal anaphora.

2. Meeting the challenge

Von Fintel and Iatridou (2017: §3.1) give the impression that modal subordination across *and* is always degraded with an explicit deontic modal in the first conjunct.[5] But there is no degradation in conjunctions that don't involve a discourse relation of explanation:

(10)   a.   Contact your superior and she will explain your next mission.
       b.   You must contact your superior and she will explain your next mission.

Investigating these good examples, and comparing them to the bad ones yields deeper insight. However, the most important ingredient for understanding these conjunctions is the temporal differences between simple imperatives and modals.

Modals, unlike imperatives, involve *two* eventualities: both of the modality holding — the requirement of contacting your superior — and of the described eventuality — contacting your superior.[6] Crucially, it is the modal eventuality which serves as the argument of higher operators. This is evident with adverbials, which are notoriously sensitive in the same way. The contrast observed by Gärtner (2017) regarding adverbial modifications of imperatives and deontic modals is telling:

(11)   a.   #Usually, contact your superior.
       b.   Usually, you must contact your superior.

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[5]See von Fintel and Iatridou (2017: fn15) where they grant the existence of naturally occurring examples, but maintain that they are degraded.

[6]To be more precise, modal sentences involve three eventualities and imperatives two, since both also involve the utterance event itself. It is arguably this eventuality that is involved in the interpretation of indexicals like *now* and 'metatalk' discourse relations.

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Adverbs like *regularly* that scope low do not exhibit this contrast:

(12)   a.   Contact your superior regularly.
        b.   You must contact your superior regularly.

Together, this suggests that imperatives differ fundamentally from necessity modals in that they do not make the necessity itself available as an eventuality to other operators. This insight is directly relevant to IaDs, since discourse relations are fundamentally temporal, and are sensitive to the eventualities topicalized by the conjuncts. In particular, it follows that conjunctions with a modal conjunct will be infelicitous where the corresponding IaDs are felicitous because the discourse relations are relating *different eventualities*. The challenge, then, is to explain why this leads to different behavior in (7) and (10).

Let me first explain why (7a) is felicitous and (7b) is not.[7]

(7)   a.   Invest in this company and you will become rich.
       b.   #You must invest in this company and you will become rich.

Von Fintel and Iatridou (2017) are on the right track when the say that (7b) is not felicitous because it attempts to combine an explanation relation with conjunction. But, crucially, that failed explanation interpretation relates *the state of being required to invest* and you becoming rich. No such interpretation is possible for (7a) since the imperative, as detailed above, does not make that state salient. This general limitation is made clear by (13).

(13)   ??Invest in this company because you will become rich.

It is perhaps useful to note that (13) is not anomalous because of a general problem with imperatives and *because*:

(14)   Donate blood because our reserves are low.

Further, it is often felicitous to explicitly assert an explanation relation for a modal, where it is infelicitous with an imperative.

(15)   a.   ??Report for duty because your contract requires you to.
        b.   You must report for duty because your contract requires you to.

All of this evidence suggests that (7a) does not involve an explanation relation, even though (7b) does. (7a) instead involves the relation RESULT.[8] (16a) makes this point clear, while (16b)

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[7]Throughout, I will assume familiarity with the basic discourse relations discussed by Kehler (2004), Asher and Lascarides (2003) and Hobbs (1985). While I will follow the general definitions from Kehler and Hobbs, I will assume with Asher and Lascarides (2003) that fully adequate definitions must appeal to eventualities rather than just propositions. Please see these references for further details.

[8]RESULT is typically defined as follows (Kehler 2004: 247): where S_1 and S_2 are the related sentences, infer P from the assertion of S_1 and Q from the assertion of S_2, where normally $P \rightarrow Q$. To generalize to where S_1 is an imperative, appealing to eventualities helps: e_1 is the topical eventuality of S_1 and e_2 of S_2, where normally

shows that such an interpretation with the explicit modal would be anomalous.

(16) a. Invest in this company and, as a result, you will become rich.
      b. ??You must invest in this company and, as a result, you will become rich.

The anomaly in (16b) lays bare the situation. Of course (16b) is not felicitous on the same reading as (16a), since that would amount to saying that your riches will result from the state of being (prudentially) required to invest in the company. In short, the contrast von Fintel and Iatridou (2017: §3.1) offer between (7a) and (7b) is manufactured by two different discourse relations, and the complication that imperatives and modals make different eventualities available to those discourse relations. No general point about modal anaphora between conjuncts follows from this though. von Fintel and Iatridou (2017: §3.1) are absolutely right that this anaphoric dependence cannot be assimilated to modal subordination in the strict sense. But this does not preclude a more general *modal anaphora* approach whereby the *will* of the second clause anaphorically retrieves a restriction on its domain from the first clause.

So much for the contrast in (7). What about the lack of any such contrast in (10)? Unlike (7), (10) involves the same discourse relation in the imperative and modal variants, and, somehow, this interpretation works for both variants. (10) clearly involves the relation of OCCASION (Kehler 2004: §3.1.3, Hobbs 1985: 10). Since this relation is a bit more complex, let me explain more precisely what it is. Kehler (2004: 242) offers (17a) as a paradigm example of OCCASION, while (17b) illustrates the limits of OCCASION.[9]

(17) a. George delivered his tax plan to Congress. The Senate scheduled a debate for next week.
      b. ?George delivered his tax plan to Congress. The Senate scheduled hearings into former President Clinton's pardon of Marc Rich.

The crucial feature in (17a) is that elements of a complex situation through an intermediate state of affairs that serves to connect two parts of that complex situation: the state where the tax plan has been delivered to the Senate connects that delivery, and the scheduling of the debate. Unlike RESULT this relation can be much more complex and nuanced that cause/effect or defeasible entailment. For example, the tax plan could only be a very small and minor component of the debate, but procedurally required for scheduling the debate. This highlights how domain knowledge, such as protocol, can inform the inference of OCCASION. (17b) makes clear that this is a substantive constraint. When there is no perceived script (prototypical chain of events) connecting the two events, this discourse is not coherent.

$Causes(e_1, e_2)$ — *Causes* is a non-monotonic conditional-like operator (Asher and Lascarides 2003).

[9]OCCASION between S_1 and S_2 is typically defined as: (i) a change of state can be inferred from the assertion of S_1, whose final state can be inferred from S_2; or (ii) a change of state can be inferred from the assertion of S_2, whose initial state can be inferred from S_1 (Hobbs 1985: 10). Here, the terms of 'final' and initial should be understood in terms of prototypical sequences of events, given relevant domain knowledge. I will generalize this by understanding OCCASION as follows: (i) e_1 is the topical eventuality of S_1, e_2 is the topical eventuality of S_2 and e_1 results in a change of state whose final state results from e_2; or (ii) e_1 is the topical eventuality of S_1, e_2 is the topical eventuality of S_2 and e_2 results in a change of state whose initial state results from e_1.

Returning now to imperatives, Hobbs (1985: 10) actually offers the imperatives in (18) as a paradigm illustration of OCCASION at work:

(18)   a.   Walk out the door of this building.
        b.   Turn left.
        c.   Go to the corner.

A complex situation, namely the sequence of actions needed to get the addressee to a specific location, is explained through a series of intermediate states of affairs that connect the events described by each sentence. The imperative (18a) introduces a change of location whose result holds during the event described in the next imperative (18b), and similarly for (18b) and (18c). This helps clarify that OCCASION is often at work with imperatives, and the fact that *and* could be placed between these sentences makes clear that conjunction is compatible with *and*. It also further clarifies that OCCASION is very different from RESULT in that it needn't involve a cause/effect relationship. With all this in mind, let us consider why OCCASION supports both variants in (10).

(10)   a.   Contact your superior and she will explain your next mission.
        b.   You must contact your superior and she will explain your next mission.

The operation of OCCASION in (10a) is clear enough. The causal result of contacting your superior produces a state that leads to the goal of the discourse: an informed agent. But, how does OCCASION work in (10b), given that the first conjunct topicalizes the state of being required to contact your superior, rather than the event of you contacting them? The prototypical result of that requirement is fulfillment, which connects the conjuncts as before. The reliance on prototypical sequences of events allows OCCASION this inferential flexibility.

As Kehler (2004) and Hobbs (1985) highlight, OCCASION is highly sensitive to surprising nuances of human cognition and discourse goals. From the infelicity of (7b), we can infer that there is no relevant prototypical sequence of events connecting a prudential requirement to invest and becoming rich that satisfies the agents' domain goals. On reflection, that is an independently plausible description of the natural context for (7). The discourse goal, presumably, is for the speaker to convince an undecided hearer to invest. This means that there is no shared 'final state' which OCCASION can target with a prototypical chain of events. On reflection, it is clear that (10) involves a case where speaker and hearer have a shared 'final state', allowing the speaker to invoke a prototypical chain of events culminating in that final state. While these nuanced differences are easy to miss when studying isolated examples, they are precisely the details that form the natural habitat of human discourse.

One more piece of data from von Fintel and Iatridou (2017: §3.1) needs to be addressed: the polarity switch contrast in (9a) and (9c).

(9)   a.   Don't park there! You'll be towed.
        b.   = Don't park there! If you park there, you'll be towed.
        c.   ≠ Don't park there and you'll be towed.

It has been established thus far that modal anaphora between conjuncts is very much a live explanation of Type I IaDs. From this perspective, (9a) involves complement anaphora. But then (9c) is exactly what one expects, given that complement anaphora is known to be incompatible with conjunction (Nouwen 2003).

(19)   a.   Few congressmen admire Kennedy. They think he's incompetent.
        b.   #Few congressmen admire Kennedy and they think he's incompetent.

This means that a fully general theory of modal anaphora can appeal to the same mechanisms at work in (19) to explain (9), all while sticking with an explanation of Type I IaDs on which the second conjunct anaphorically retrieves a proposition made salient by the first conjunct. I now turn to that analysis.

3. Preference semantics with modal anaphora

This section will adapt the dynamic preference semantics from Starr (to appear) to offer analyses of Type I and Type II IaDs. After introducing this basic analysis of imperatives and connectives in §3.1, I will turn to Type I IaDs in §3.2 and Type II IaDs in §3.3. There are three key innovations in these sections. The first is to model the process by which modal anaphora generates a conditional meaning in Type I IaDs. The second is to model the meaning of $_{LS}and$ in a way that neutralizes the directive meaning of the first conjunct. The third is capturing the fact that negative Type II IaDs seem to entail the prohibition of the first conjunct. In particular, it will be shown that this can be captured as a simple contextual entailment on a dynamic preference semantics. Together, these innovations explain the basic data of (3)-(5) from §1. Throughout this section, my presentation of the semantics will aim only to convey the basic ideas and innovations. Full formal definitions are reserved for Appendix 4.

3.1. Preference semantics for imperatives

The data discussed so far places non-trivial restrictions on the kind of imperative semantics that can be used to explain IaDs. The data discussed in §2 are problematic for modal analyses like Kaufmann (2012) and Aloni (2007). This problem is avoided by static non-propositional analyses like Portner (2004) and Roberts (2015) which assign imperatives and declaratives to distinct semantic types and to distinct pragmatic context update rules. As Starr (to appear) argues in detail, those two commitments make it impossible to adequately capture conjunctions like (2) and other related examples. Starr (to appear) addresses this limitation by adopting a dynamic preference semantics for imperatives. A dynamic semantics also makes capturing the anaphoric dynamics within a conjunction far easier. The basic idea of this dynamic semantics for imperatives is simple: !A introduces a preference for A-worlds over ¬A-worlds.[10] This basic idea can be represented graphically as in Figure 1. Here, worlds are dots with a capital letter indicating truth and lowercase falsity and preferences are indicated with complimentary pairs

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[10]While Portner (2004) has the primary pragmatic effect of imperatives to be the update of a To-do List, a secondary effect is that the To-do List is used to generate an ordering of worlds from the context set. By contrast, the account here has the primary semantic meaning of imperatives be an update on an ordering. Having an ordering over sets of worlds affords a useful resource for conditional imperatives (Starr to appear).
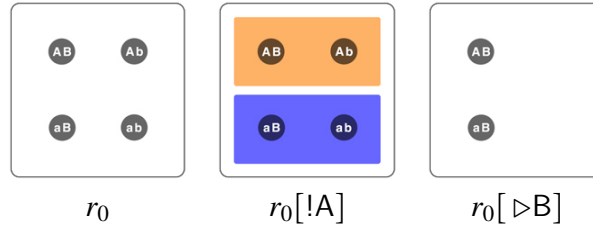
Figure 1: Imperative and Declarative Updates

of colors. The warm color of the pair is used for the preferred alternative. This makes clear that the meaning of imperatives is dynamic: its meaning is specified in terms of how it changes a preference relation r. It also clarifies how imperatives and declaratives differ. A declarative $\triangleright B$ would eliminate $\neg B$-worlds entirely.

Formally, a preference relation is a set of pairs of propositions: $r = \{\langle p_1, p_2 \rangle, \ldots, \langle p_n, p_m \rangle\}$. The context set is reconstructed by unioning all of the ranked alternatives: $c_r = \bigcup (\operatorname{dom} r \cup \operatorname{ran} r)$. r_0 simply ranks all the worlds over the empty set: $r_0 = \{\langle \{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}, \varnothing \rangle\}$. So !A changes r to $\{\langle p_1, p_2 \rangle, \ldots, \langle p_n, p_m \rangle, \langle c_r \cap [\![A]\!], c_r - [\![A]\!] \rangle\}$, while the declarative $\triangleright A$ will eliminate $\neg A$-worlds from each proposition ranked in r. On this approach, $[\phi]$ is the meaning of ϕ, applying to r to yield r': $r[\phi] = r'$.[11] To analyze disjunction, Starr (to appear) lifts the type of states to *sets of preference relations*, and calls them *preference states*. Since disjunction is not at issue here, I will present the system in the simpler form here.

In this framework, conjunction can be analyzed in the standard dynamic way, sequential update: $r[\phi \wedge \psi] = (r[\phi])[\psi]$. Unlike a static analysis like Portner (2004), this allows imperatives and declaratives to fluidly combine. It offers an immediate account of examples like (2) which would have the general form of $\triangleright B \wedge !A$. The result is depicted in Figure 2. This result plausibly
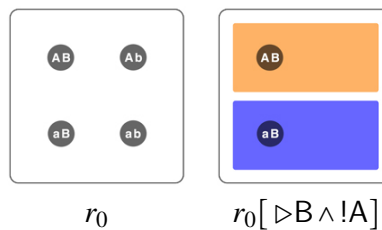

Figure 2: Update with a DaI (Declarative-and-Imperative)

gives the meaning of mixed conjunctions like (2), but not for Type I IaDs. Applying this analysis to (3a) does not capture the fact that it only commits the speaker to making chile in worlds where the addressee makes tortillas.

(3)   a.   Make tortillas and I'll make chile.

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[11]While I borrow the notation from Veltman (1996), this is not an update semantics in the technical sense defined by Veltman (1996): it is not generally true that $r \subseteq r[!A]$.

To capture this feature of (3a), one has to model the anaphoric relationship between the conjuncts. Further, since discourse relations mediate this anaphora and feature into the interpretation of conjunction itself, a more complex interpretation of *and* is needed. This will be addressed in §3.2. For now, I will turn to introducing some further details about this general approach to imperatives that will be used below.

In order to explain (3)-(5) from §1, it is necessary to define notions of support and consistency for imperatives. Developing these concepts in an adequate way is rather difficult for a non-propositional analysis. Static analyses like Portner (2004) do not provide adequate definitions of these concepts, but a dynamic preference semantics provides useful resources here (Starr to appear). Like other dynamic accounts (e.g. van Rooij 2000; van Benthem and Liu 2007; Portner 2012), I will model the logic of imperatives in terms of how they update an ordering of alternatives. Dynamic accounts of *informational support* ($\vDash$) hold that c informationally supports ϕ just in case updating c with ϕ doesn't change c (e.g. Veltman 1996). This idea can be applied here by focusing on *preferential support*:

Preferential Support $r \Vdash \phi \iff r[\phi] = r$.

This notion of support will be relied upon to explain the felicity (or lack thereof) for the *so* follow ups in (3b)-(5b). The basic idea is that $\mathsf{So}(!A)$ is felicitous just in case $!A$ is preferentially supported by the preference relation that results from updating with prior discourse.

Preferential consistency is understood with an eye to the practical function of preferences: they are to motivate choices. Accordingly, inconsistent preferences are those that would not facilitate choosing an alternative. This is particularly clear when considering contrary imperatives, and the preferences they lead to, as depicted in Figure 3. The resulting preference relation
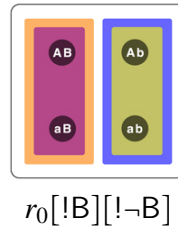

$$r_0[!\mathsf{B}][!\neg\mathsf{B}]$$

Figure 3: Contrary Imperatives Lead to Cyclic Preferences

$r_0[!\mathsf{B}][!\neg\mathsf{B}]$ is irrational because it has a cyclic subset $\{\langle b,\overline{b}\rangle,\langle\overline{b},b\rangle\}$. These preferences are irrational in a practical way: it would be defective for motivating choices because every alternative is worse than another. Starr (to appear) details the conditions preferences must have to be rational in this sense. For our purposes here, acyclicity is all that will matter. Preferential inconsistency simply requires that the sentences never lead to a rational preference relation:

Preferential Inconsistency
> ϕ and ψ are preferentially inconsistent just in case there is no r such that $r[\phi][\psi]$ is rational.
> (See Starr to appear for the relevant definition of *rational*.)

This will be used to explain the infelicity of *but* follow-ups in (3b)-(5b). The basic idea is that But(ϕ) is not felicitous when ϕ is preferentially or informationally inconsistent with the prior sentences in the discourse.

3.2. Type I IaDs

There are a number of feasible ways to capture the anaphoric conditional meaning of *will* in the second conjunct. The analysis proposed here makes three key assumptions.

Essential Features of Analysis

1. !A introduces an eventuality or proposition — the event or proposition that A — that subsequent operators can anaphorically retrieve (Hobbs 1985; Lascarides and Asher 2003 and Murray and Starr to appear).
2. *Will* can anaphorically retrieve the eventuality or proposition introduced by !A to treat as its domain of universal quantification (Frank and Kamp 1997; Stone 1999; Stojnić 2016).
3. The anaphoric interpretation of *will* is mediated by inferred discourse relations (Hobbs 1985; Lascarides and Asher 2003; Stojnić 2016).

Since *will* has a partly temporal semantics, and discourse relations primarily relate eventualities, no analysis of IaDs will be complete without attending to temporal issues. However, doing so also introduces a number of complexities that are peripheral to the main project here. Accordingly, I will offer a purely modal analysis of *will* caste in a stack-based update semantics similar to Kaufmann (2000). This implementation choice introduces three inessential assumptions that are worth highlighting at the outset.

Inessential Implementation Features

1. Modals like *will* are tests (Veltman 1996).
2. *Will* expresses simple epistemic necessity with respect to c_r (Kaufmann 2000).
3. By default, *will* is anaphoric to the previously introduced modal topic.

It would be perfectly feasible to recast the basic analysis presented here within Kratzer's (1981) approach to modality, integrating temporality in any of a number of ways (Portner 2009: Ch.5). Or, one could treat *will* as having a purely temporal semantics and make use of the eventuality introduced by imperatives. Any analysis within these broad families could be made to fit with the general proposal that follows. On the third inessential feature, it is important to clarify that this is not presumed to be an empirically justified default, but rather an attempt to abstract from the complex details of anaphora resolution and discourse structure.[12] While this limits the empirical testability of the theory as stated, this is just as it should be. I am not attempting to predict particular anaphoric patterns here, but just show how to characterize the anaphoric interpretations when they do arise.

As highlighted above, I will treat Will(A) as a test that all of the worlds drawn from some

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[12]For one plausible account of these complexities see Stojnić (2016).

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contextually salient information source are worlds where A is true. If this test is passed, then the input r is returned; otherwise the empty relation results. On this approach, $!A \wedge \mathsf{Will}(B)$ should first introduce a preference for A-worlds and then test that all of these A-worlds are B-worlds. As Figure 4 shows, a preference relation like r_0 fails this test but one like r_1 passes it. As the diagram for $r_1[!A \wedge \mathsf{Will}(B)]$ makes clear, B only has to hold among the live A-worlds.

$$r_0 \qquad\qquad r_0[!A \wedge \mathsf{Will}(B)] \qquad\qquad r_1 \qquad\qquad r_1[!A \wedge \mathsf{Will}(B)]$$
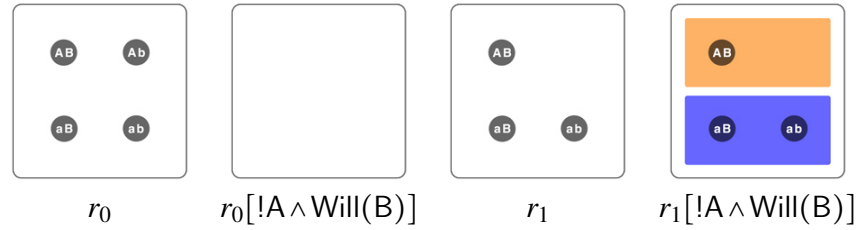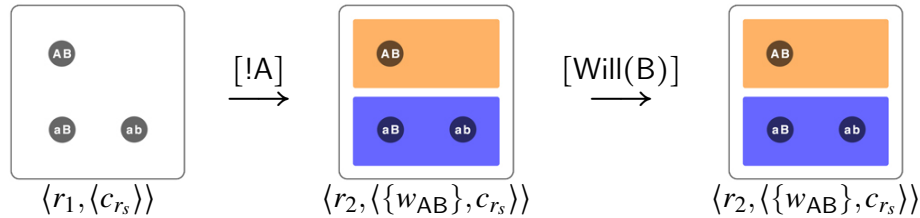
Figure 4: Type I IaDs

While this specifies the target interpretation, I have not said how it is compositionally produced. This is achieved by defining updates over *states*.

A state $s = \langle r_s, d_s \rangle$ pairs a preference relation r_s with a tuple of modal discourse topics $d_s = \langle p_i, \ldots, p_j, c_{r_s} \rangle$, which are just sets of worlds. The context set c_{r_s} is always a possible modal discourse topic, so d_s will always contain c_{r_s} — I reserve the last slot of d_s for c_{r_s}. Now, in addition to introducing a preference for A-worlds, $!A$ will also append those A-worlds to the front of d_s. $\mathsf{Will}(B)$ can then anaphorically retrieve its domain from $d_{s[!A]}$: it tests that B holds throughout the first modal topic in $d_{s[!A]}$. This is laid out in Figure 5, which illustrates how $\mathsf{Will}(B)$ gains access to the A-worlds. This basic approach to the semantics also provides a

$$\langle r_1, \langle c_{r_s} \rangle \rangle \qquad\qquad \langle r_2, \langle \{w_{AB}\}, c_{r_s} \rangle \rangle \qquad\qquad \langle r_2, \langle \{w_{AB}\}, c_{r_s} \rangle \rangle$$

Figure 5: Anaphoric Interpretation of $!A \wedge \mathsf{Will}(B)$

way of capturing the anaphoric interpretation of imperatives themselves, as in (18). Of course, to make this a comprehensive analysis for any of the data presented here, one needs an actual theory of anaphora resolution rather than assuming that *will* is always anaphoric when it follows an imperative across *and* or a discourse segment. For conjunctions, this would involve specifying $s[!A][DR_{\wedge}][\mathsf{Will}(B)]$, where $DR_{\wedge}$ is a non-montonically inferred discourse relation lexically compatible with *and* which specifies whether or not $\mathsf{Will}(B)$ gets interpreted in a state where the A-worlds are the first discourse topic. Non-anaphoric discourse relations could detopicalize those A-worlds. The same style of analysis would work across discourse segments, where the lexical constraints on discourse relations are lifted.

Here's why (3b) is infelicitous. So $!\neg A$ is infelicitous after $!A \wedge \mathsf{Will}(B)$ because $!\neg A$ is not preferentially supported by $!A \wedge \mathsf{Will}(B)$ in this context. $!\neg A$ will add a preference for $\neg A$-worlds that $!A \wedge \mathsf{Will}(B)$ does not require to be present. But $!\neg A$ is infelicitous after $!A \wedge \mathsf{Will}(B)$

because it requires at a minimum that $!A \wedge \text{Will}(B)$ and $!\neg A$ are preferentially consistent. But that leads to preferences like Figure 3 — the paradigm case of a preferential inconsistency.

3.3. Type II IaDs

The central challenge for Type II IaDs is to explain both how the conditional interpretation arises, and how the directive meaning of the imperative conjunct is neutralized. As Culicover and Jackendoff (1997) observe, these features also arise with some declarative conjuncts:

(20)   a.   You drink another can of beer and I'm leaving.
        b.   Big Louie sees you with the loot and he puts out a contract on you.

Neither variant involves asserting the first conjunct, just as neither (4a) nor (5a) involve directives. Culicover and Jackendoff (1997) propose that there is a semantic ambiguity between the familiar meaning of *and* and the *left-subordinating and* ($_{LS}and$) in (20). This general approach to Type II IaDs has been pursued by Russell (2007), Kaufmann (2012), Klinedinst and Rothschild (2012), among others. It also coheres nicely with an experimental study of IaDs (Scontras and Gibson 2011). This study compared quantitative acceptability ratings of emphatic *do* and explicit subjects in Type I and Type II IaDs across a large sample of naive speakers. They found that these elements very significantly decreased the acceptability of Type II IaDs, but not Type I IaDs. I will pursue a variant of this ambiguity analysis below, showing how it is possible to relate the two meanings of *and* and allow imperatives to have their normal directive semantics without having their normal directive effect on context. But a brief word about alternative analyses is in order.

Keshet (2013) and Keshet and Medeiros (2017) argue that the Type I/Type II distinction is a fundamentally syntactic, scopal one. Imperatives are taken to be modal operators, and it is maintained that Type II IaDs involve that modal scoping over the entire conjunction with the first conjunct serving as the restrictor and the second as the nuclear scope. On this approach, Type II IaDs are not really conjoined imperatives and declaratives, but rather a complex type of modal sentence. (Though Type I IaDs are true conjunctions of imperatives and declaratives.) This approach has the merit of not postulating an ambiguity in *and*, and does not require any account of how the first imperative's directive fore is neutralized. The latter achievement is particularly attractive since some existing accounts of the neutralization like Han (1998) and Russell (2007) are problematic. I will not follow this syntactic approach since I think it is problematic to treat imperatives as modal operators for the reasons discussed in §2 and Starr (to appear). However, I take seriously the merits of this approach and speak to them below.

Similar to the 'parameter shifting *and*' defined in Klinedinst and Rothschild (2012), I propose that the first conjunct of $_{LS}and$ only has its effect on d_s.

Semantics of $_{LS}and$ $s[\phi_{LS}\wedge\psi] = (\langle s, d_{s[\phi]}\rangle)[\psi]$

This does not attribute completely unrelated meanings to $_{LS}\wedge$ and $\wedge$: while $\wedge$ sequentially up-

dates both components of states, $_{LS}\wedge$ only updates one of them. Klinedinst and Rothschild (2012) argue that this a general feature of connectives that a multidimensional dynamic framework is well-suited to capture. This variant of conjunction neutralizes the first conjunct's effect on r_s and allows the conditional interpretation to be derived anaphorically just as with Type I IaDs, i.e. by inferring appropriate discourse relations between the conjuncts. Just as with *and*, there must be substantial constraints on which discourse relations are compatible with $_{LS}and$ — indeed it is clear that it must require subordinating discourse relations like Explanation, Instance, Background, Elaboration, Generalization, etc. Presumably something like this restriction would be needed to explain why not all combinations of tense/aspect work in purely declarative $_{LS}and$ constructions, and why emphatic *do* degrades Type II IaDs. Unfortunately, this component of the analysis is beyond the scope of this paper.

On this approach, (5a) amounts to $!M_{LS}\wedge\mathsf{Will}(\mathsf{F})$. Crucially, $!M$ only contributes its modal discourse topic to the state in which the second conjunct is evaluated. As with Type I IaDs, the conditional reading is generated when *will* is anaphoric to this topic. (As discussed above, the conditional readings of (20a) and (20b) would have to be derived from inferred subordinating discourse relations.) This not only explains the conditional interpretation, and the lack of directive meaning. It explains why $\mathsf{So}!\neg M$ is an infelicitous follow-up while $\mathsf{But}!\neg M$ is felicitous. Updating $!M_{LS}\wedge\mathsf{Will}(\mathsf{F})$ has no effect directly on the preferences, so it cannot guarantee that the preferences added by $!\neg M$ will already be present in the state. Thus $\mathsf{So}!\neg M$ is infelicitous. However, for the same reason, $!M_{LS}\wedge\mathsf{Will}(\mathsf{F})$ and $!\neg M$ are preferentially consistent. Further, there is no tension between this context an the contrastive content of *but*, so $\mathsf{But}!\neg M$ is felicitous. I now turn to Type II IaDs like (4a).

Contextual Preference r_2 $s_0\big[!S_{LS}\wedge\mathsf{Will}(\mathsf{R})\big]$ $\langle r_2,\langle c_{r_2}\rangle\rangle\big[!S_{LS}\wedge\mathsf{Will}(\mathsf{R})\big]$
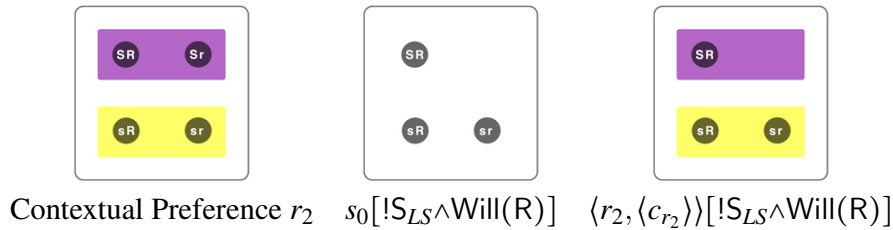
Figure 6: Negative Preferences and Type II IaDs

Explaining the pattern in (4b) requires examining more closely the context in which (4a) occurs. Both speaker and hearer can take it for granted that worlds where the speaker doesn't rub chile in the hearer's eye ($\neg R$) are preferable to ones where they do (R). This background context is depicted as r_2 in Figure 6. The Type II IaD (4b) *Screw up the tortillas and I'll rub chile in your eye* is represented as $!S_{LS}\wedge\mathsf{Will}(\mathsf{R})$ and, in general, rules out the world w_{Sr}, depicted in Figure 6. So in its natural context, $!S_{LS}\wedge\mathsf{Will}(\mathsf{R})$ will lead to the third preference relation depicted in Figure 6. This explains why $\mathsf{So}!\neg S$ is a felicitous follow-up while $\mathsf{But}!\neg S$ is not. $\langle r_2,\langle c_{r_2}\rangle\rangle\big[!S_{LS}\wedge\mathsf{Will}(\mathsf{R})\big]$ is a state that preferentially supports $!\neg S$: the imperative would impose a preference already in place. For this reason, the contrastive or contrary-to-expectations content of *but* rules out $\mathsf{But}!\neg S$ as a follow up, though it is preferentially consistent.

4. Conclusion

This paper has proposed an analysis of IaDs that captures their conditional meaning as modal anaphora and explains the contrasts between types of IaDs exhibited in (3)-(5). I argued that this modal anaphora approach can be made to meet the challenges posed by von Fintel and Iatridou (2017) if it draws a sharp distinction between modals and imperatives. The dynamic, non-modal analysis has much in common with Lascarides and Asher (2003), in particular its reliance on inferred discourse relations. But, instead of founding the Type I/Type II distinction purely in the inferred discourse relation, I followed Klinedinst and Rothschild (2012) in taking this distinction to involve two semantically overlapping connectives. This made it possible to neutralize the directive meaning of the first conjunct without the problematic assumptions made by Han (1998) and Russell (2007).[13] By relating imperatives to preferences instead of actions as Lascarides and Asher (2003) do, it was possible to explain the interaction of contextual preferences with the interpretation of negative IaDs. Future work is needed to spell out the resolution of discourse relations in this analysis and to extend it to conditional readings of disjunctions (e.g. Franke 2005 and Biezma and Rawlins 2016).

Appendix A. Dynamic Logic of Mood with Modal Anaphora

Definition 1 (DLMA Syntax)

$$(1) \qquad \alpha \in \mathcal{R}ad \quad \text{if } \alpha \in At = \{\mathsf{A}, \mathsf{B}, \mathsf{C}, \mathsf{D}, \dots\}$$
$$(2) \qquad \neg\rho \in \mathcal{R}ad \quad \text{if } \rho \in \mathcal{R}ad$$
$$(3) \ (\rho_1 \wedge \rho_2) \in \mathcal{R}ad \quad \text{if } \rho_1, \rho_2 \in \mathcal{R}ad$$

$$(4) \quad \mathsf{Will}(\rho) \in \mathcal{S}ent \quad \text{if } \rho \in \mathcal{R}ad$$
$$(5) \qquad \rhd\rho \in \mathcal{S}ent \quad \text{if } \rho \in \mathcal{R}ad$$
$$(6) \qquad !\rho \in \mathcal{S}ent \quad \text{if } \rho \in \mathcal{R}ad$$
$$(7) \ (\phi \wedge \psi) \in \mathcal{S}ent \quad \text{if } \phi, \psi \in \mathcal{S}ent$$
$$(8) \qquad \neg\phi \in \mathcal{S}ent \quad \text{if } \phi = \mathsf{Will}(\rho) \ \& \ \rho \in \mathcal{R}ad$$

Definition 2 (Preference Relations)

1. A **preference relation** r is a relation on propositions
   - W is the set of possible worlds; each assigns every atomic radical to one truth-value
     - $W{:}At \mapsto \{0, 1\}$
   - $r{:}\wp(W) \times \wp(W)$
2. r's **context set** c_r is the union of propositions ranked by r.
   - $c_r = \text{field}\, r$, where $\text{field}\, r = \text{dom}\, r \cup \text{ran}\, r$

Definition 3 (States)

A *state* $s = \langle r_s, d_s \rangle$ is a pair consisting of a preference relation r_s and an n-tuple of propositions $d_s = \langle p_i, \dots, p_j, c_{r_s} \rangle \in \wp(W)^n$, where $n \geqslant 1$.

- d_s is the list of modal discourse topics.
- d_s always contains c_{r_s} as its last element; c_{r_s} is always a discourse topic.
- When $n = 1$, $d_s = \langle c_{r_s} \rangle$.

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[13]Han (1998) employs a controversial feature deletion, while Russell (2007) incorrectly assumes that Type II IaDs involve an infinitive rather than an imperative (von Fintel and Iatridou 2017: §3.4).

Definition 4 (Initial State) $\mathbf{I} := \langle \{\langle W, \varnothing \rangle\}, \langle W \rangle \rangle$

Definition 5 (Atomic Radical Semantics) For $c \subseteq W$, $\alpha \in At$: $c[\alpha] = \{w \in c \mid w(\alpha) = 1\}$

Definition 6 (Imperative Semantics)
$s[!\rho] = \langle r_s \cup \{\langle c_{r_s}[\rho], c_{r_s} - c_{r_s}[\rho]\rangle\}, c_{r_s}[\rho] \circ d_s\rangle$
- $q \circ d_s := \langle q, p_n, \dots, p_1 \rangle \in \wp(W)^{n+1}$ where $q \subseteq W$, $d_s = \langle p_n, \dots p_1 \rangle \in \wp(W)^n$ and $n \geqslant 1$.

Definition 7 (Declarative Semantics)
$s[\triangleright\rho] = \langle r_s + \rho, c_{r_s}[\rho] \bullet d_s\rangle$, where $r_s + \rho = \{\langle a[\rho], a'[\rho]\rangle \mid \langle a, a'\rangle \in r_s \ \& \ a[\rho] \neq \varnothing\}$.
- $q \bullet d_s := \langle q, p_n, \dots, q \cap p_1 \rangle \in \wp(W)^{n+1}$ where $q \subseteq W$, $d_s = \langle p_n, \dots p_1 \rangle \in \wp(W)^n$ and $n \geqslant 1$.

Definition 8 (Will Semantics)
$s[\mathrm{Will}(\rho)] = \langle \{\langle a, a'\rangle \in r_s \mid 1(d_s)[\rho] = c_{r_s}\}, d_s\rangle$, where $1(d_s)$ is the first element of d_s.

Remark 1 Definition 8 does not have *will* introduce any modal topics, but that is only for simplicity. At the very least, it should probably introduce $1(d_s)[\rho]$ as a modal topic — but exploring the relevant data here is not possible.

Definition 9 (Connective Semantics) $\rho, \rho_1, \rho_2 \in \mathcal{R}ad$; $\phi, \psi, \neg\phi \in Sent$

1. $c[\rho_1 \wedge \rho_2] = (c[\rho_1])[\rho_2]$ 3. $s[\phi \wedge \psi] = (s[\phi])[\psi]$
2. $c[\neg\rho] = c - c[\rho]$ 4. $s[\neg\phi] = s \ominus s[\phi]$

- $s \ominus s' := \langle \{\langle a_1, a_2\rangle \mid a_1 = a_3 - c_{s'} \ \& \ a_2 = a_4 - c_{s'} \ \& \ \langle a_3, a_4\rangle \in r_s\}, d_s\rangle$
  - $s \ominus s'$ removes any modal topics in s' and not in s, and removes worlds from every alternative in r_s that are in $c_{r_{s'}}$.

Definition 10 ($_{LS}$*and* Semantics)
$s[\phi_{LS} \wedge \psi] = (\langle s, d_{s[\phi]}\rangle)[\psi]$

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