Factive-implicatives and modalized complements[*]

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1.   Introduction

Verbs like *remember* appear to induce a shift in entailment patterns conditional on the finiteness of their complement.

(1)   a. Bo_i remembered that he_i took the trash out.
       b.   Bo remembered to take the trash out.

(2)   Bo took out the trash.

Both (1a) and (1b) imply that (2). But the implicational relationship (1a) bears to (2) is different from the one (1b) does. When (1a) is negated, questioned, or embedded in the antecedent of a conditional, the resulting sentence nonetheless implies (2). This suggests that the complement of *remember* in (1a) is presupposed and thus that *remember* is factive.

(3)   a. Bo_i didn't remember that he_i took the trash out.
       b.   Did Bo_i remember that he_i took the trash out?
       c.   If Bo_i remembered that he_i took the trash out, then he told Jo so.

The picture changes in considering (1b). When negated, questioned or embedded in the antecedent of a conditional, the resulting sentence no longer implies the truth of (2). And even more strikingly, negation, questioning, and supposition of the matrix interact with the embedded content: (4a) implies the negation of (2), (4b) questions (2), and (4c) supposes (2). This is a complete reversal relative to the finite case, where the embedded content is inert; and it suggests that (2) is an entailment—but crucially not a presupposition—of (1b).

(4)   a.   Bo didn't remember to take the trash out.
       b.   Did Bo remember to take the trash out?
       c.   If Bo remembered to take the trash out, then he told Jo so.

Karttunen (1971) called verbs that give rise to the second pattern of entailments—e.g. *forget*, *manage*, and *fail*—implicative verbs. As such, I refer to these entailments as implicative entailments. Thus, it appears that *remember* is factive when it takes finite complements and implicative when it takes infinitival control complements. I refer to such verbs—e.g. *forget*, *know*, and *neglect*—as factive-implicatives (FIs).[1]

The existence of FIs raises a puzzle. Note that the nonfactive *hope* can also take infinitival control complements and that the implicative *turn out* can take finite complements. This suggests that both factivity and implicativity are distributionally independent of finiteness.

(5)   Bo hoped to take out the trash.

(6)   It turned out that Bo took out the trash.

But given this distributional independence, why should factivity and implicativity ever modulate with respect finiteness, as they appear to with FIs? That is, why should factivity and implicativity be independent of finiteness in distribution but not interpretation? I refer to this puzzle as the Distributional-Interpretational Divergence Puzzle (DIDP).

In this paper, I resolve the DIDP by denying that distribution and interpretation in fact diverge. The central observation from which this analysis will be built is that, though (1b) does not presuppose (2), it does presuppose (7b). That is, the presupposed content of (1b) overlaps with that of (7a).

(7)   a. Bo_i remembered that he_i had to take the trash out.
       b.   Bo had to take the trash out.
       c.   Bo took out the trash.

I claim that the reason the presupposed contents of (1b) and (7a) overlap is that (1b) is in fact an impoverished version of (7a). But whereas the complement in (7a) has all the trappings of a full clause—e.g. tense and aspect—the complement in (1b) is likely much smaller (Grano 2012). I show that this smaller constituent minimally contains an element that contributes the modality found in (1b)'s presupposition (Abusch 2004, Wurmbrand 2014)—henceforth, its presuppositional modality.

To explain how (1b)'s implicative entailments are generated, I draw a direct link between these entailments and what Bhatt (1999) dubbed actuality entailments. Actuality entailments are a widely attested phenomenon in which a sentence of the form MODAL p gives rise to the entailment p under certain conditions (Hacquard 2006).

Note that something akin to this can be seen in (7b), which gives rise to a strong implicature that (7c). Seizing on this analogy, I claim that FIs' implicative entailments just are actuality entailments. Specifically, they are actuality entailments that arise as a consequence of the modal element appearing in a nonfinite context.

The remainder of the paper is structured as follows. In section 2, I investigate two different ways of resolving the DIDP. I entertain—but eventually reject—the proposal that

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[1]Factive-implicatives stand in contrast to implicatives that do not also take finite complements, such as *manage* and *fail*. In this paper, I remain agnostic about the relationship between FIs and this other type. See Karttunen 2012 and the database referenced therein (fn. 8) for an extensive list of implicatives, some of which are FIs.

remember is ambiguous between a factive and an implicative variant. In section 3, I give evidence that FIs in control contexts are—at least semantically—monoclausal and that this property correlates with the presence of implicative entailments. Section 4 sketches an implementation of the analysis that derives implicative entailments as actuality entailments of an embedded modal. In section 5, I conclude.

2.   Modalized complements

Upon definition, it seems immediately clear how to resolve the DIDP: why not just say that FIs are ambiguous between a factive variant, e.g. *remember*$_{fact}$, and an implicative variant, e.g. *remember*$_{imp}$? Then, distribution and interpretation don't diverge because there is no single verb for which they could diverge.

I refer to this first approach as the ambiguity hypothesis. I contrast the ambiguity hypothesis with what I take to be the null hypothesis whenever a question of homonymy arises: that in fact the lexical item in question is the same across the contexts in question. Thus, the null hypothesis here would be that the finite-taking FI is the same as the infinitival-taking FI. I refer to this approach as the uniformity hypothesis.

Under either hypothesis, one needs to explain not only how presuppositions and implicative entailments arise, but also how they get the contents they do. In this section, I address the source of FIs' presuppositional modality (PM). There are again two options: either the PM is encoded in the FI (FI-encoding) or it is encoded in the infinitival complement (complement-encoding). At least one of the possible combinations this yields—the uniformity hypothesis with FI-encoding—is a non-starter.

Suppose that the uniformity hypothesis were true and that the modality were encoded in the FI. Then, the FI should also modalize its presuppositions in the finite case. But (8b) is felicitous with an explicit denial of obligation—in contrast to (8a)—suggesting that PM does not arise in (8b). Therefore, this hypothesis can be ruled out.

(8)   a.   Bo remembered to clean the kitchen, # even though he wasn't allowed to.
        b.   Bo remembered that he cleaned the kitchen, even though he wasn't allowed to

This is not really surprising: if FIs modalized their presuppositions in the finite case, one might have hesitated to class them with other factives in the first place, since their presuppositions would look distinct from those other factives. Nonetheless, it might shine a favorable light on the ambiguity hypothesis. If FIs have separate implicative variants, encoding PM in those variants might work.

Unfortunately, a similar problem arises. Note that *remember* can distribute over the conjunction of a *that*-CP and a control complement (9a); and it can be gapped (9b).

(9)   a.   Bo remembered to go to the store and that Jo asked him to grab cereal.
        b.   Bo remembered to wash the dishes and Jo, that the dog needed a walk.

For the ambiguity hypothesis to cover these data—whether FI-encoding or complement-encoding hold—it would need to posit that either *remember*$_{fact}$ or *remember*$_{imp}$ has a wider distribution than previously thought. But if PM is FI-encoded, *remember*$_{imp}$ cannot have a

wider distribution; by hypothesis, it would encode the PM, and it was already established that modalized presuppositions don't arise with finite complements (unless those complements themselves contain a modal).

If *remember_{fact}* had a wider distribution and the PM were FI-encoded, the modalized presupposition should be detachable from (9a) and (9b), since *remember_{fact}* does not modalize its presupposition. If it were detachable, there should be a reading of (9a) and (9b) on which which (10a) and (10b) are felicitous. But there are no such readings. Thus, the ambiguity hypothesis with FI-encoding must be rejected. And since the uniformity hypothesis with FI-encoding was also rejected, FI-encoding can be rejected wholesale. That is, an account on which the PM is encoded in the factive-implicative will not work.

(10)   a.   *In the same context as* (9a): # Bo wasn't supposed to go to the store.
        b.   *In the same context as* (9b): # Bo wasn't supposed to wash the dishes.

This means that the source of the PM must be the infinitival. But this still leaves the choice between an ambiguity and a uniformity hypothesis unresolved. Note, however, that the sort of explanation the ambiguity hypothesis would need to advance is unparsimonious. Regardless of whether one assumes that *remember_{fact}* occurs in both (9a) and (9b) or that *remember_{imp}* occurs in both (9a) and (9b), it would need to be explained why implicative entailments arise in the first conjunct but not the second. But if that can be done with a single variant, it is unclear what work the other variant does. Thus, I assume that the uniformity hypothesis with the PM encoded in the infinitival complement is to be preferred.

This hypothesis nicely explains the PM facts. If there is only one variant of each FI relevant to the finite-infinitival distinction, the FI is expected to behave the same across these two contexts. One such behavior that they should share is presupposition of their complement. And since the PM is encoded in FI complements and not FIs themselves, the modality encoded in the FI complement is correctly predicted to end up in the presupposition.

This hypothesis, however, heightens the stakes with respect to the DIDP. At the beginning of this section, I noted that the ambiguity hypothesis provides a swift resolution to the DIDP, since it denies the existence of a single lexical item whose factivity could interact with finiteness to give rise to implicative entailments. But if a uniform lexical item is to be retained, the presence of implicative entailments must be explained without direct reference to factivity. I pursue this in the next section.

3.   Semantic restructuring

Assuming that the uniformity hypothesis is correct, one simple way to generate implicative entailments would be to stipulate the rule in (11). This rule will cover the data seen so far—trivially so, since it is simply a restatement of the original observation—but it will do so at a cost: this rule makes explicit reference to factivity as a condition on implicative entailments. In accepting this rule with no further explanation, it would then be necessary to accept that distribution and interpretation can diverge, thus leaving the DIDP unresolved.

(11)   If *V* is factive, then *X V to VP* → *X VP* and *X not V to VP* → *X not VP*

In this section, I show that, while such a rule covers the data, it seems to be missing a generalization about other semantic properties that correlate with implicative entailments. In light of these correlations, I propose an alternative account of implicative entailments that derives them as actuality entailments of the infinitival complement's modal element.

I begin with a discussion of what I refer to as semantic restructuring (SR). A verb undergoes SR if and only if the event(uality) that the embedded predicate is predicated of (the embedded event)—e.g. *fill the bird feeder* in (12)—is available for modification from the matrix. The reason for calling this phenomenon SR is that, if the embedded event is available for modification from the matrix (matrix-accessible), then the sentence is "semantically" monclausal—what would be an embedded event in the finite case is a matrix(-accessible) event in the infinitival case.[2]

(12)   Bo remembered to fill the bird feeder.

To investigate the SR properties of sentences like (12), I adapt a test used by Hacquard (2008) to show that Italian *volere* restructures.[3] The idea is to set up contexts in which either the matrix or embedded events are never realized. *Again* is then inserted into the matrix and felicity checked. If an infelicity arises, this suggests, *ceteris paribus*, that *again* is modifying the matrix or embedded event, respectively, at that attachment site.

In the finite case, the *again* test suggests that embedded events are not modifiable from the matrix. This can be seen in that the matrix attachment site is good in (13a), when there is no previous filling event. If *again* were modifying the embedded event, infelicity would be expected, since the lack of a previous filling event would leave nothing for *again* to refer to. In contrast, the matrix attachment is bad in (13b), when there is no previous remembering event. This is expected if *again* only modifies the matrix event. And it further shows that (13a) is not good due to an ambiguity between matrix and embedded event modification. If (13a) were so ambiguous, that ambiguity should be able to save (13b).

(13)   *Jo told Bo to fill the bird feeder.*
    a.   *He remembered this but didn't fill it. The next week, she asked again.*
          Bo again remembered that he had to fill the feeder.
    b.   *He forgot this, but noticed it was empty and filled it anyway. She told him to again the next week.*
          # Bo again remembered that he had to fill the feeder.

The same pattern does not hold for the infinitival case. Unlike (13a), (14a) is bad without a previous filling. This suggests that—not only <u>can</u> the matrix *again* modify the embedded event—it <u>must</u>. This is quite surprising; why should the embedded event be accessible from the matrix? I suggest in section 4 that in fact this has to do with the impovisherment of the embedded constituent in collusion with the modal element contained in that constituent.

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[2]I discuss this as "semantic" restructuring as opposed to simply restructuring because it is inconsequential for the current analysis whether the structures of interest pass standard syntactic restructuring tests (see Grano 2012, for an extensive recent discussion of such tests). And though syntactic and semantic restructuring are likely highly correlated, it is at least logically possible that a verb could undergo one but not the other.

[3]See Von Stechow 1996 and Beck and Johnson 2004 for discussion of this test.

(14)   *Jo told Bo to fill the bird feeder.*

    a.   *He remembered that he had to, but didn't. The next week, she asked again.*
       # Bo again remembered to fill the feeder.

    b.   *He forgot this, but noticed it was empty and filled it anyway. She told him to*
       again the next week.
       # Bo again remembered to fill the feeder.

This is not the only aspect that is surprising about the data in (14). Like (13b), (14b) is bad. This cannot be due to *again* modifying the embedded event, since the embedded event has a previous realization. This suggests that *again* is modifying the matrix event. In concert with (14a), this implies that *again* is simultaneously modifying both the remembering event and the filling event. I explain this in section 4 as a consequence of a rule of combination that puts FIs together with their infinitival complements. The specific explanation I pursue is that, in fact, *again* in (14) modifies a single compound event of remembering and filling.

    Interestingly, the pattern in (14) does not appear to be a function of finiteness alone. Note that (15) patterns with (13) in terms of the embedded event's accessibility: Bo need not have acquired tickets previously for the matrix *again* to be felicitous. Thus, *remember that* and *hope to* pattern alike in terms of SR—in contrast to *remember to*.

(15)   *Bo hoped to get a ticket to Jo's show. He couldn't, but when Jo came again…*
    Bo again hoped to get a ticket.

But what relevance does any of this have for deriving implicative entailments in such a way that the DIDP is resolved? To set the stage, let me first specify and then reject one way the DIDP might have been resolved.

    I have already noted that (16a) gives rise to implicative entailments and (16c) does not. I also noted that (16b), like (16a), presupposes (17a). (17a) in turn gives rise to a strong implicature (17b). One possibility for how (16a) gives rise to implicative entailments is that its presupposition (17a) gives rise to the strong implicature (17b). That is, (16a)'s implicative entailment would be derived as an actuality entailment not of (16a) directly, but of its presupposition. This would in turn predict that the finite variant (16b) would give rise to the same entailment. If such a link existed, it could be good news for resolving the DIDP, since it could mean that, though factivity is involved in generating implicative entailments, it doesn't do so conditional on finiteness; and thus finiteness does not condition the interpretation in the way it first appeared to.

(16)   a.   Bo remembered to take out the trash.
      b.   Bo remembered that he had to take out the trash.
      c.   Bo hoped to take out the trash.

(17)   a.   Bo had to take out the trash.
      b.   Bo took out the trash.

The problem with this account is that (16b) does not appear to give rise to implicative/actuality entailments. Note that (18) has a felicitous reading. This means that not all modalized presuppositions give rise to actuality entailments—a problem for the above account.

(18)   Bo remembered that he had to take out the trash, but he didn't end up doing it.

But all is not lost. The DIDP could still be resolved by a second route as long as there is some property—not finiteness—that is correlated with implicative entailments. In fact, SR seems to be such a property. Note that the data in (18) suggest that (16b) patterns with (16c) in terms of implicative entailments. Further, both *hope to* and *remember that* pattern together in terms of SR—to the exclusion of *remember to*. This in turn may suggest a link between SR and implicative entailments. If such a link existed, it could allow a resolution to the DIDP that chalks implicative entailments up, not to an interaction between factivity and finiteness, but to some property that itself correlates with finiteness. In the next section, I spell out what this resolution would look like in more detail.

4.   Implementation

In this section, I first show how to derive the modification facts in the finite case. I then move on to my proposal regarding the source of the PM and how to derive the correlation between SR and implicative entailments. I begin with a hybrid Hintikkan-Kratzerian attitude verb denotation.[4] Here, *remember* requires that the event(uality) it is predicated of be a memory. It then quantifies over worlds compatible with this event. For the remainder of this section, I give the shorthand $\text{REMEMBER}(e, w_1, w_2)$ for the restrictor in (19).

(19) $[\![\text{remember}]\!] = \lambda p.\lambda e.\lambda w_1. \left[\forall w_2 : \begin{array}{c} e \text{ is a memory in } w_1 \\ \& \\ w_2 \text{ accords with the contents of } e \end{array} \right] (p(w_2))$

I assume that $[\![\text{CP}_{that}]\!]$ is a proposition and that *that* is an identity function for propositions. When $[\![\text{remember}]\!]$ is applied to $[\![\text{CP}_{that}]\!]$, it binds that $[\![\text{CP}_{that}]\!]$'s world argument.

(20) $[\![\text{remember CP}_{that}]\!] = \lambda e_1.\lambda w_1. \left[\forall w_2 : \text{REMEMBER}(e_1, w_1, w_2) \right] \left([\![\text{CP}_{that}]\!](w_2) \right)$

I further assume that aspect existentially closes the event in $[\![\text{VP}]\!]$, a property of events.[5] Because it will be important later, note that $[\![\text{AspP}]\!]$ quantifies over the domain of events in world w, D_v^w. The final piece necessary for deriving the modification facts in section 3 is $[\![\text{again}]\!]$, which I assume is a predicate of events.

(21) $[\![[\text{Asp VP}]_{AspP}]\!] = \lambda t.\lambda w.\exists e \in D_v^w : R(e,t) \,\&\, [\![\text{VP}]\!](e)(w)$

(22) $[\![\text{again}]\!] = \lambda e.\text{AGAIN}(e)$

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[4]This denotation shares with Kratzer's (2006) that attitudes are predicated of events and that quantification over worlds is restricted by contents. However, the restriction by contents encoded in (19) is more akin to Hacquard's (2010) in that events—and not content individuals—are mapped to propositions (see Moulton 2008, for further discussion of this distinction). It also diverges in encoding quantification in the attitude, more like a standard Hintikkan (1969) approach. These decisions are made mostly for the sake of ease of exposition; it is likely that the analysis can also be be stated using either a purely Hintikkan or purely Kratzerian approach. The obstacle I see to the former is that it will be cumbersome to explain the modification facts.

[5]I show the time-event relation R to make clear that $[\![\text{Asp}]\!]$ does more than existential closure, but for my purposes, existential closure is the only relevant piece of $[\![\text{Asp}]\!]$, so R will henceforth be suppressed.

Assuming that CP_{that} contains an AspP, the embedded VP event will be closed below CP. At any position in the matrix, *again* is thus too high to modify the embedded event.[6]

(23) $[\![CP_{that}]\!] = \lambda w \ldots \exists e \in D_v^w : \ldots [\![VP]\!](e)(w)$

(24) $[\![\text{remember } CP_{that}]\!] = \lambda e_1.\lambda w_1.\big[\forall w_2 : \text{REMEMBER}(e_1, w_1, w_2)\big]$
$$\big(\ldots \exists e_2 \in D_v^{w_2} : \ldots [\![VP]\!](e_2)(w_2)\big)$$

I assume here that $[\![again]\!] \in D_{vt}$ is combined with $[\![\text{remember } CP_{that}]\!] \in D_{v(st)}$ via Restrict (Chung and Ladusaw 2004). This yields modification of only the matrix memory event(uality), which is consonant with the modification facts in section 3.

(25) $[\![\text{again [remember } CP_{that}]]\!] = \lambda e_1.\lambda w_1.\text{AGAIN}(e_1)$ &
$$\big[\forall w_2 : \text{REMEMBER}(e_1, w_1, w_2)\big]$$
$$\big(\ldots \exists e_2 \in D_v^{w_2} : \ldots [\![VP]\!](e_2)(w_2)\big)$$

I now turn to the question what contributes the modality in the infinitival complement. The astute reader will have noted in section 2 that, beyond providing evidence against the ambiguity hypotheses, the coordination data in (9a) and (9b) also suggest that FIs' finite and control complements are of the same syntactic type. And given that *that* heads a CP, this suggests that the infinitival complement is also a CP.

Assuming that the PM is encoded somewhere in the complement, as was shown in section 2, and that control complements of FIs are indeed CPs, it is necessary to specify which element within the infinitival CP contributes the presuppositional modality. I propose, on analogy with Bhatt's (1999) analysis of non-subject infinitival relatives, that the presuppositional modality is encoded in the complementizer itself.[7] I henceforth refer to this modal complementizer as C_{mod}

$[\![C_{Mod}]\!]$ must satisfy at least two constraints. First, it must encode root modality. I assume a standard[8] Kratzerian (1981, 1991) approach to modal semantics, where B is the modal base and O is the ordering source.[9] I henceforth use the shorthand $\text{BEST}_{B,O,w_1}(w_2)$ for the restrictor of $[\![C_{mod}]\!]$.

Second, in order to explain the semantic restructuring data, $[\![C_{Mod}]\!]$ must be defined such that the VP event can later be modified from the matrix. To do this, I define $[\![C_{Mod}]\!]$ such that it binds the event variable of the function it is applied to: $[\![VP]\!]$.[10] This does not

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[6]I suppress all content in the embedded clause besides the existential quantification coming from aspect in (23), since it is irrelevant.

[7]This proposal is similar in spirit to Wurmbrand's (2014), in which verbs like *hope* embed a ModP headed by *woll*. I return to the relationship between her proposal and the current one in section 5.

[8]Note that only the use quantification over a modal base that is ordered by an ordering source is standard.

[9]Whether the B and O are context sensitive like a standard Kratzerian (1981, 1991) modal is unclear. Minimally, there must be some way of ensuring that O represents obligations. One possibility is that these are relative to the attitude event (Hacquard 2010).

[10]It is possible that the constituent C_{Mod} merges with is a vP (Grano 2012). It does not seem to matter in terms of type, under the assumption that both $[\![VP]\!]$, $[\![vP]\!] \in D_{v(st)}$, though it may matter in terms of the thematic roles that are licit with both the matrix and embedded events. I will assume that this constituent is a VP, though not too much should be read into this assumption.

guarantee that the embedded VP event will be modifiable at the correct position in the matrix, but it makes such modification possible.

(26) $\llbracket C_{Mod} \rrbracket^{B,O} = \lambda f_{v(st)}.\lambda e.\lambda w_1.\left[\forall w_2 : w_2 \text{ is an } O\text{-Best } B\text{-world in } w_1\right]\left(f_{v(st)}(e)(w_2)\right)$

It is important here to highlight how C_{Mod} differs from complementizers like *that*. Unlike *that*, C_{Mod} returns a property of events instead of a proposition—again, there needs to be some way of keeping the embedded event accessible for modification. But this means that C_{Mod} does not return the right type for combination with *remember*, nor can it take the denotation of a full clause as its argument.

On the one hand, this seems right: maybe there is a principled semantic split between complementizers that take full clauses and those that take VP/vP denotations. Specifically, *that*-type complementizers take full clause denotations and return propositions; $\llbracket C_{Mod} \rrbracket$ takes VP denotations and returns properties of events. On the other hand, if C_{Mod} returns a property of events and *that* returns a proposition, how can the coordination data that suggested that $\llbracket C_{Mod} \rrbracket$ was a C be explained? I return to this tension in section 5.

I next show how to derive presuppositional modality, matrix-accessibility of the embedded event, and implicative entailments. Note that $\llbracket CP_{Mod} \rrbracket$ will be a property of events. This is a problem because $\llbracket remember \rrbracket$ requires a proposition. Thus, some rule of combination is needed for putting the two together. As shown in section 3, however *remember* and C_{Mod} combine, they need to be amenable to both being modified by the same adverb; remember, this is so because of the surprising pattern of facts in (14). To do this, I encode directly into the restructuring rule that the remembering event e_1 and the embedding VP event e_2 are subparts of an event e_0.

(27)   **Rule of Semantic Restructuring (RSR)**[11]
         If X is the parent of nodes Y and Z (and no others) and $\llbracket Y \rrbracket$ is of type $((st)v(e(st)))$ and $\llbracket Z \rrbracket$ is of type $(v(st))$ then $\llbracket X \rrbracket = \lambda e_0.\llbracket Y \rrbracket(\llbracket Z \rrbracket(e_2))(e_1) \ \& \ e_0 = e_1 \oplus e_2$

With this rule in hand, it is now possible to derive the modification facts. Applying RSR to $\llbracket remember \rrbracket$ and $\llbracket C_{Mod} \rrbracket$ yields (28). When this is combined with $\llbracket again \rrbracket$, again via Restrict, (29) results.

(28) $\llbracket remember \ CP_{Mod} \rrbracket = \lambda e_0.\lambda w_1.e_0 = e_1 \oplus e_2 \ \&$
$$\left[\forall w_2 : \text{REMEMBER}(e_1, w_1, w_2)\right]$$
$$\left(\begin{array}{c} \left[\forall w_3 : \text{BEST}_{B,O,w_2}(w_3)\right] \\ (\llbracket VP \rrbracket(e_2)(w_3)) \end{array}\right)$$

(29) $\llbracket again \ [remember \ CP_{Mod}] \rrbracket = \lambda e_0.\lambda w_1.\text{AGAIN}(e_0) \ \& \ \llbracket remember \ CP_{Mod} \rrbracket(e_0)(w_1)$

This is exactly the right result: that e_0, the compound remembering-embedded VP event, happens again. If either the remembering or the embedded VP event never happened before, infelicity would result.

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[11]Paul Portner (p.c.) noted about a previous iteration of this combinator that it was type-theoretically identical to a standard S-combinator. A standard S-combinator will not work here since it would yield a denotation in which the same event is both a memory and a VP event.

With the accessibility data explained, I now show how restructuring gives rise to implicative entailments under this implementation. Following Hacquard (2006, 2009), I assume that (perfective) aspect quantifies over the domain of events in the local evaluation world.[12] For matrix aspect, this local world will be the actual world. Thus, the matrix aspect quantifies over actual events.

In (30), the compound event is bound by the matrix aspect, and so that event will be in the actual world.[13] This provides a formal identity between FI implicative entailments and actuality entailments. Thus, the correlation between SR and implicativity is explained: without SR, the compound event that the embedded VP event is part of would not have been bound by the matrix aspect.[14] And it is this binding by the matrix aspect that results in the implicative/actuality entailments.

(30) $[\![\text{remember CP}_{Mod}]\!] = \lambda w_1.\exists e_0 \in D_v^{w_1} : \ldots\; e_0 = e_1 \oplus e_2\; \&$
$$\left[\forall w_2 : \text{REMEMBER}(e_1, w_1, w_2)\right]\left(\begin{matrix}\left[\forall w_3 : \text{BEST}_{B,O,w_2}(w_3)\right]\\ ([\![\text{VP}]\!](e_2)(w_3))\end{matrix}\right)$$

To derive negated implicative entailments under this account, the only further assumption needed is that negation is interpreted above aspect. (31) is just (30) with wide-scope negation. This yields (31), which requires that no actual event be a remembering-to-VP.

(31) $[\![\text{didn't remember CP}_{Mod}]\!] = \ldots \neg\exists e_0 \in D_v^{w_1} : \ldots [\forall w_2 \ldots]([\forall w_3 \ldots]([\![VP]\!](e_2)(w_3)))$
$\&\; e_0 = e_1 \oplus e_2$

This will not similarly predict negated implicative entailments for the finite variant, since the negated existential quantifier binds the remembering event, not a compound event.

(32) $[\![\text{didn't remember CP}_{that}]\!] = \ldots \neg\exists e_1 \ldots [\forall w_2 : \text{REMEMBER}(e_1, w_1, w_2)]$
$(\ldots \exists e_2 \ldots ([\![VP]\!](e_2)(w_2)))$

Thus, implicative entailments are derived only in the nonfinite case, and the correlation between implicative entailments and semantic restructuring is explained.

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[12]In contrast, imperfective aspect introduces a layer of modality above the event quantification (Bhatt 1999). For Bhatt and Hacquard, binding an event by imperfective aspect would destroy actuality entailments. Since the implicative entailments of *remember* appear to be indestructable, an explanation is then required for why *remember* cannot occur with imperfective aspect. Space constraints do not allow a full discussion of this, but as preliminary evidence, note that *remember* can only appear in the progressive when it takes *that*-CPs.

(i)   a.   I'm now remembering that I had to take out the trash.
        b.   #I'm now remembering to take out the trash.

This might be attributed to some incompatibility between the properties of the compound event and the way in which imperfective aspect relates that event to the relevant time.

[13]I have suppressed irrelevant material in (30), such as the thematic role introduced by little *v*.

[14]Note that it is not necessary to adopt the Bhatt/Hacquard analysis of actuality entailments here. It is sufficient for my purposes that FI's implicative entailments are actuality entailments. See Mari and Martin 2007, Homer 2010, Giannakidou and Staraki 2013 for alternative accounts of actuality entailments.

5.   General Discussion

The goal of this paper was to explain why the semanticopragmatic properties of factive-implicatives change so radically conditional on whether their embedded clause is tensed. The specific property of interest was factivity: when FIs take a *that*-CP, they presuppose their embedded complement; and when they take a control infinitival, they merely entail that complement. This phenomenon was interesting because it made it appear that factivity is interacting with a syntactosemantic distinction—finiteness—that it is otherwise independent of: both factives and non-factives can appear with infinitival complements.

The tack I took was to show that the apparent nonindependence between factivity and embedded tense was an illusion. The nature of the FI does not change; rather, various aspects of the structures they appear in collude to make it seem that way. Specifically, I claimed that the FIs' modalized presuppositions belie a modal element in the embedded clause. This modal, in concert with semantic restructuring, gives rise to the observed implicative entailments.

But one might accept this account yet still deny that it does much more than solve the puzzle by lexical stipulation; that it is no better than positing (11) from section 3. Such a charge is at least partially predicated on the assumption that the modal complementizer does no other work in the system. But this may not be the case. I've alluded throughout the paper to Wurmbrand's (2014) proposal that verbs like *hope* and *expect* embed a future modal. Interestingly, these same verbs pass the coordination test that *remember* passes (section 2). If this is taken as evidence that there is a complementizer in the first conjunct of (33), it suggests that, in fact, *hope* also takes a modal complementizer.[15]

(33)   Jo hoped/expected to get coal in her stocking and that it would be inky black.

But then why doesn't *hope to* give rise to implicative/actuality entailments? The answer may be that *hope to* does not undergo SR. I showed in section 3 that *hope to* patterns with *remember that* in this respect. Further, Wurmbrand shows that beneath the modal element *hope* embeds, there needs to be an aspect head. For my purpose, the presence of this aspect head could be sufficient to close the event in just the way that's needed in order to explain the pattern of restructuring data for *hope*.

Of course, this would require tweaks to the current implementation: as noted in section 4, C_{Mod} couldn't handle this as implemented. And of course, all of this must be fit into a constrained theory of the lexicon; it may be that complementizers like C_{Mod} are too powerful.

Nonetheless, C_{Mod} may not be too far off the mark—at least type-theoretically—if recent proposals regarding event relativity at the left periphery are correct. For instance, Hacquard (2010) suggests that matrix attitude verbs need to be able to bind events in the embedded clause in order to explain certain facts about the interpretation of modals. One way of cashing this out is to assume that all non-WH complementizers, including *that*, are of the same type as C_{Mod}. This would in turn explain why *that* and C_{Mod} can be coordinated.

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[15] And even if *hope* doesn't take such a complementizer, (33) suggests, at the very least, that *remember* and *hope* may be subcategorized by things of the same syntactic type.

References

Abusch, Dorit. 2004. On the temporal composition of infinitives. In *The syntax of time*, 27–53. MIT Press.

Beck, Sigrid, and Kyle Johnson. 2004. Double objects again. *Linguistic Inquiry* 35:97–123.

Bhatt, Rajesh. 1999. Covert modality in non-finite contexts. Doctoral Dissertation, University of Pennsylvania.

Chung, Sandra, and William A Ladusaw. 2004. *Restriction and saturation*, volume 42. MIT press.

Giannakidou, Anastasia, and Eleni Staraki. 2013. Rethinking ability: ability as modality and ability as action. In *Genericity*, ed. Alda Mari, Claire Beyssade, and Fabio Del Prete, 250–275. Oxford University Press.

Grano, Thomas Angelo. 2012. Control and restructuring at the syntax-semantics interface. Doctoral Dissertation, The University of Chicago.

Hacquard, Valentine. 2006. Aspects of modality. Doctoral Dissertation, Massachusetts Institute of Technology.

Hacquard, Valentine. 2008. Restructuring and implicative properties of volere. In *Proceedings of SuB12*, ed. Atle Grønn.

Hacquard, Valentine. 2009. On the interaction of aspect and modal auxiliaries. *Linguistics and Philosophy* 32:279–315.

Hacquard, Valentine. 2010. On the event relativity of modal auxiliaries. *Natural language semantics* 18:79–114.

Hintikka, Jaakko. 1969. Semantics for propositional attitudes. In *Models for modalities*, 87–111. Springer.

Homer, Vincent. 2010. Actuality entailments in french: A case of aspectual coercion. In *Proceedings of WCCFL*, volume 28.

Karttunen, Lauri. 1971. Implicative verbs. *Language* 340–358.

Karttunen, Lauri. 2012. Simple and phrasal implicatives. In *Proceedings of the First Joint Conference on Lexical and Computational Semantics*, 124–131. Association for Computational Linguistics.

Kratzer, Angelika. 1981. The notional category of modality. In *Words, worlds, and contexts: New approaches in word semantics*, ed. HJ Eikmeyer and H. Reiser, 38–74.

Kratzer, Angelika. 1991. Modality. In *Semantics: An international handbook of contemporary research*, ed. A. von Stechow and D. Wunderlich, 639–650.

Kratzer, Angelika. 2006. Decomposing attitude verbs. Talk in honor of A. Mittwoch. The Hebrew University Jerusalem.

Mari, Alda, and Fabienne Martin. 2007. Tense, abilities and actuality entailment. In *Proceedings of the Sixteenth Amsterdam Colloquium*, 151–156.

Moulton, Keir. 2008. Clausal complementation and the *Wager*-class. In *Proceedings of NELS*, ed. A. Schardl and M. Walkow, volume 38. GLSA Publications: Amherst, MA.

Von Stechow, Arnim. 1996. The different readings of wieder again: A structural account. *Journal of semantics* 13:87–138.

Wurmbrand, Susi. 2014. Tense and aspect in English infinitives. *Linguistic Inquiry* 45:to appear.