The Temporal Orientation of Infinitives

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The puzzle: Infinitival complements display three possible temporal interpretations (Abusch, 2004). Predicates such as *believe*, *claim*, *pretend*, and emotive factives like *be glad*, obligatorily have a simultaneous complement. Infinitival complements to *expect*, *hope* and *want* receive an interpretation of future orientation. But, given the appropriate context, they too can receive a simultaneous interpretation. Finally, the verbs *promise*, *ask*, *order*, and *allow* (in its active form) are necessarily future oriented.

(1) a. John {pretends/claims/is glad/believes Mary} to be at the party (*tomorrow).
b. John {expects/hopes/wants Mary} to be at the party (tomorrow).
c. John {promised/asked/ordered/allowed} Mary to be at the party (tomorrow).

Portner (2018) notes that work on the temporal orientation of infinitives is still fragmentary, and while the literature contains some insights, there is still little explanation as to why these facts hold. Wurmbrand (2014) propose to capture this via syntactic selection: only the predicates in (1b,c) select for a clause headed by a covert modal. Yet, such a proposal fails to capture the obvious role of the lexical semantics of the verbs in question. Equally, however, semantic accounts (e.g., Katz, 2001; Pearson, 2016) often do little more than stipulate the temporal orientation of these predicates by building it into their lexical semantics. On both approaches, there is no explanation as to why a given verb falls into one of these classes rather than another.

The proposal in brief: We begin with the assumption that posteriority in English is uniformly introduced by a covert future operator Op_{FUT} (see below for discussion of finite clauses).

(2) $$[\![\mathbf{Op}_{\text{FUT}}(\phi)]\!]^{w,t} = \exists t' > t : [\![\phi]\!]^{w,t'} = 1$$

We will propose that the lexical semantics of the various verbs in (1) predictably constrain the distribution of Op_{FUT} in such a way that it is ruled out under the predicates in (1a), optional under those in (1b), and necessary under those in (1c). We show how this works for each class.

Simultaneous predicates (1a): Firstly, we propose that a doxastic modal base triggers the presupposition that the modal base is diverse with respect to future oriented propositions. This presupposition, which we term *lack of foreknowledge* (after Kaufmann, 2005), is stated in (3a) and formalised in (3b). This presupposition is carried by all modal expression which have a doxastic modal base. It is also inherited by any predicate which quantifies over a superset of a doxastic modal base (if X contains p and $\neg p$ worlds, then any superset of X contains p and $\neg p$ worlds). Two such sets of worlds are the worlds compatible with the *common ground* (Stalnaker, 1978 *et seq.*), and an epistemic modal base relative to the same individual, time, and world. This constraint will be additionally motivated by data from epistemic modals.

(3) *Lack of Foreknowledge*
a. For any doxastic modal base D, and proposition p. There is a world-time index in D for which there is a future time at which p is true, and there is a world-time index in D for which there is no future time at which p is true.
b. $$\forall x_e, w_s, t_i, p_{\langle i,\langle s,t\rangle\rangle} : \exists \langle w', t'\rangle \in \text{Dox}_x^{w,t} : \exists t'' > t' : [\![p]\!]^{w',t''} = 1 \wedge \exists \langle w'', t'''\rangle \in \text{Dox}_x^{w,t} : \neg\exists t'''' > t''' : [\![p]\!]^{w'',t''''} = 1$$

In combination with a standard semantics for *believe*, the presupposition stated above rules out an infinitival complement to *believe* containing Op_{FUT}.

(4) $$[\![\alpha \textbf{ believe } \phi]\!]^{w,t} = \forall \langle w', t'\rangle \in \text{Dox}_\alpha^{w,t} : [\![\phi]\!]^{w',t'} = 1$$

For the truth conditions of a sentence containing a future oriented infinitival complement to *believe* to be met, all world-time pairs in Dox must have a succeeding time at which the prejacent of Op_{FUT} is true. However, the presupposition requires that for any proposition (including the

prejacent of Op_{FUT}), there must be some world-time pair in Dox for which there is no future time at which the proposition is true. The presupposition contradicts the assertion, and following Gajewsky (2002), Chierchia (2013) among others, we assume that sentences which are trivially true or false due to their logical form are judged unacceptable. Turning to *claim*, we adopt a semantics like that in Anand & Hacquard (2009) which states that the goal of a claim is for the complement to be accepted into the common ground. However, since the set of worlds compatible with the common ground is always a superset of the doxastic alternatives of each of the discourse participants, it will inherit the presupposition mentioned above, and can be shown to also derive a contradiction if it embeds Op_{FUT}. If *claim* were negated, the presupposition would ensure that the assertion is trivially true, and the sentence would also be judged unacceptable. The counterfactual verb *pretend* presupposes that the prejacent is false throughout the attitude holder's doxastic alternatives. This presupposition will again contradict the presupposition *lack of foreknowledge*. Finally, emotive factives (e.g., *be glad*) presuppose both that the attitude holder believes the complement to be true, and also that its complement is common ground. Embedding Op_{FUT} under *be glad* is thus correctly ruled out.

Future Oriented Predicates (1b): For the future oriented predicates *expect* and *hope*, we follow Heim (1992), von Fintel (1999), and Villalta (2008) in proposing that predicates such as these have an ordering semantics (Kratzer, 1977, 1981, 2012), and they presuppose that their doxastic modal base is diverse (Anand & Hacquard, 2013).

(5) $[\![\alpha \textbf{ hope } \phi]\!]^{w,t} =$ defined iff
$\exists \langle w'', t'' \rangle \in \text{Dox}_{\alpha}^{w,t} : [\![\phi]\!]^{w'',t''} = 1 \wedge \exists \langle w''', t''' \rangle \in \text{Dox}_{\alpha}^{w,t} : [\![\phi]\!]^{w''',t'''} = 0$
if defined, $= 1$ iff $\forall \langle w', t' \rangle \in \text{Max}_{\text{BOUL}_{\alpha}^{w,t}}(\text{Dox}_{\alpha}^{w,t})$: $[\![\phi]\!]^{w',t'} = 1$

The semantics for *expect* is identical *modulo* replacing the bouletic ordering source with one of likelihood (von Fintel, 1999). When these verbs embed Op_{FUT}, both the assertion and the uncertainty presupposition are compatible with *lack of foreknowledge*. However, this semantics also accommodates the observation that *expect* can have a simultaneous reading provided uncertainty on the part of the attitude holder is presupposed (Pesetsky, 1992). The verb *want* is argued to have a modal base which is not doxastic (Anand & Hacquard, 2013), and thus does not carry an uncertainty requirement. As a result, we account for the future orientation of these verbs, as well as the observation that *hope* and *expect* can embed simultaneous infinitival complements in a more limited set of contexts than *want* (Williamson, 2017).

Future Oriented Predicates (1c): Like the previous class of verbs, future oriented infinitival complements to these verbs are not ruled out by *lack of foreknowledge*. What necessitates a future oriented reading of these complements is their (directive) deontic modality: these verbs encode the transfer of permission or obligation. We adopt the notion that states of affairs in the past or present are *presupposed to be settled* (Condoravdi, 2002) and can thus no longer be influenced. Building on Ninan (2005), we propose that one cannot oblige or permit someone to bring about a state of affairs which is presupposed to be settled, because to do so is unreasonable. We propose a principle of *reasonability* (which is not stated here due to space) that ensures that infinitival complements to the predicates in (1c) are necessarily future oriented.

Finite clauses: Finally, we show that the present proposal does not rule out future oriented finite complements to the predicates in (1a), because such sentences uniformly contain a modal auxiliary (e.g., *will*) which we argue licenses Op_{FUT}. In fact, we show that our proposal makes the welcome prediction that epistemic possibility and 'weak necessity' modals allow future oriented readings, while epistemic strong necessity modals do not (Lekakou & Nilsem, 2008).

Selected Refs: Abusch (2004). On the temporal composition of infinitives. In *The syntax of time*. • Anand, P., & Hacquard, V. (2013). Epistemics and attitudes. *Semantics and Pragmatics*. • Kaufmann, S. (2005). Condition Truth and Future Reference. *Journal of Semantics*. • von Fintel, K. (1999). NPI Licensing, Strawson Entailment, and Context Dependency. *Journal of Semantics*.