Time and modality without tenses or modals

1. Introduction

In English, reference to time in discourse involves a grammatical system of tense markers interpreted as temporal anaphors (Reichenbach 1947, Partee 1973, Webber 1988, a.o.). Recently, it has been argued that reference to hypothetical worlds in conditionals involves a parallel grammatical system of modal auxiliaries interpreted as modal anaphors (Stone 1997, Stone and Hardt 1999, Brasoveanu 2007, a.o.). Based on evidence from Kalaallisut (Esk- leut: Greenland), this paper argues that temporal and modal discourse anaphora can be just as precise in a language that does not have either anaphoric tenses or anaphoric modals.

Bittner (2005) shows that future uses of the English modals will and would have many translation equivalents in Kalaallisut. Most of these are derivational suffixes for prospect-oriented attitudinal states, e.g., expectation (-ssa, -jumaar), desire (-ssa, -rusuk, -juma), intent (-niar, -jumaar), need (-tariaaqar), anxiety (-qina), considering the prospect possible (-sinnaa), impossible (-navianngit), etc. Instead of grammatical tense, the language has a grammatical system of mood inflections that distinguish currently verifiable facts (in the declarative, interrogative, or factual mood) from current prospects (in the imperative, optative, or hypothetical mood). In this system futurity is a species of a fact. For example, the English future Ole will win translates into (1)², which asserts (-pu ‘DEC,q’) that there is a real and current state of expectation (-ssa ‘exp’) that Ann (topic, T) will win. The Kalaallisut attitudinal predicate -ssa ‘exp’ is impersonal, so the attitude holder is unspecified.

1 Aani ajuguassaaq.
Aani ajugaa-ssa-pu-q
Ann win-exp-DEC smb-3
Ann will win. (lit. is expected to)

Both fact-oriented moods and prospect-oriented attitudes also occur in Kalaallisut conditionals. Both are required even in conditionals about the past, such as the Kalaallisut translations (2)–(3) of the classic examples of Adams (1970).

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2 In the Kalaallisut examples, line 1 is in the standard Kalaallisut orthography, line 2 gives the phonemic form of each morpheme, line 3 provides the glosses, and line 4, an English translation equivalent. The glosses are in small caps for inflections (e.g. ‘DEC’), lower case for derivational suffixes (e.g. ‘not’). Abbreviations: T = topic, b = background, bel = believe, exp = expect(ed), des = desire(d), int = intend(ed), obl = obliged(to), att = attitude de se, att = attitude de b, att = attitude to prospect, rem = remote from expected or desired ideal, pssv = passive.

[ Linguistische Arbeiten: Musterseiten Sammelband ]
I propose that conditionals, too, introduce real and current attitude states into discourse. In conditionals about the past these are real states of expectation. These real mental states are based on real past events, e.g. the real assassination in (2), or real hate-mongering in (3). The modal object of the attitude are the projected consequences of these events in hypothetical antecedent worlds.

More precisely, I propose that fact-oriented moods in Kalaallisut (e.g. ‘DEC’ in (1)–(3)) constrain the last eventuality of the verb (here, the state of expectation of ‘exp’)) to be a currently verifiable fact. That is, they constrain this eventuality to be already realized, or have at least begun, in the same world as the speech act. The assertion that this eventuality is a fact can therefore be verified here and now, i.e. in the speech world at the speech time.

Next, I build on the aforementioned finding that the English modal will translates into Kalaallisut predicates that introduce prospect-oriented attitude states (Bittner 2005). For example, the predicate -ssa ‘exp’ introduces a state of expectation. By discourse-initial default, exemplified in (1), this expectation concerns the immediate future (consequent state) of the speech act (default perspective point), in the common ground (default topical modality and hence the default modal base). The attitude holder’s expectations rank the modal base worlds from the most to the least expected. Within the modal base (i.e., the common ground), in the worlds that best fit the attitude holder’s expectations, Ann wins within the consequent state of this speech act. The unspecified attitude holder of this real attitudinal state is likely to be the topic (Ann), or the speaker who is making this prediction.

In conditionals, the antecedent clause defeats discourse-initial defaults. Modally, it updates the input modal base to a topical sub-domain (see Lewis 1973, Kratzer 1981, Bittner 2001, a.o.). Temporally, it may update the perspective point. For instance, on the salient reading of the conditional (2), the real state of expectation concerns the consequent state of the real assassination event, in the topical antecedent sub-domain of the common ground where the assassin is not Oswald. Within this topical sub-domain, in the worlds that best fit the attitude holder’s expectations, the real assassination time is followed by the consequent state (-sima ‘prf’) of an assassination by another agent.

To extend this approach to counterfactuals, I propose that the suffix -galuar ‘rem(ote)’
is implicitly attitudinal: it indicates that the world of evaluation is not amongst (remote from) the ideal worlds, given the ranking of the modal base worlds by contextually salient attitudes (e.g., the beliefs or desires of the speaker or topic). For instance, the counterfactual (3) introduces a real state of expectation concerning the consequent state of a real event—for example, JFK’s enemies reaching critical mass—in the modal domain where this event is realized. In the topical sub-domain, which -galuar marks as remote from the sub-domain that best fits the speaker’s beliefs, JFK is not assassinated by Oswald. Within this remote sub-domain, the expected worlds are those where, as a consequence of his enemies reaching critical mass, JFK is assassinated by some other agent.

In what follows I first introduce an update system that can represent centering-based discourse anaphora (Section 2). The above proposal is then empirically supported and formally implemented as explicit updates for sample discourses (Sections 3–6) and a CCG fragment (Section 7). Finally, I outline an analysis of English tenses and modals in this framework and suggest that they too grammaticalize centering-based anaphora (Section 8).

2 Update with centering

2.1 Centering-based anaphora

Grosz et al. (1995) observed that in English anaphora resolution depends on the relative prominence of potential antecedents. They also introduced the term center for the discourse referent in the current center of attention and hence the top-ranked antecedent. Subsequent research has shown that centering is a semantic universal and revealed a great variety of grammatical centering systems (see e.g. Walker 1998, Chen and Yeh 2007).

Kalaallisut explicitly marks current centering status for nominal and modal referents. Nominal centering is marked by obviation (e.g. ‘3s’ vs. ‘3l’, ‘FCT3’ vs. ‘FCT1’), whereas modal centering is indicated by grammatical mood (e.g. ‘DEC’ vs. ‘FCT’) and grammatical category (e.g. inflection ‘DEC’ vs. derivation ‘-not’). Ambiguous English pronouns (e.g. in Ann’s friend has won so she’s happy) are typically disambiguated in Kalaallisut. For example, the factual dependent introduces Ann’s friend as the topic in (4a) and Ann herself as the topic in (4b). In (4a) Ann is in the background, whereas her friend is in the background in (4b). The subject pronoun in the matrix clause always refers to the topic (‘DEC3-3s’). Thus, it unambiguously refers to Ann’s friend in (4a), and to Ann, in (4b).

(4)  a. Aanip ikinngutaa ajugaagami muannaartoq.  
Aanivar ikinngut-a ajugaagaami muannaartoq  
Ann-ERG friend-3s win-FCT3-3s happy-DEC3-3s  
Ann’s friend has won so she’s happy.

b. Aanip ikinngunni ajugaammat muannaartoq.  
Aanivar ikinngun-ni ajugaammat muannaartoq  
Ann-ERG friend-3s win-FCT3-3s happy-DEC3-3s  
Ann’s friend has won so she’s happy.
In general, centering systems contrast the center (T) vs. periphery (⊥) of attention. Accordingly, Update with Centering (UC) models recentering as update from the input set of top-bottom lists (T ⊥-lists) to the output set. That is, a state of information is a set of T ⊥-lists (adapting Veltman 1996, Dekker 1994). Since discourse initially nominal anaphora is infelicitous, I propose that by default both lists start out empty, as in (5) (ignoring other types of referents). Kalaallisut (4a) and (4b) update this default state of information as in (6a) and (6b). The output state (i.e. output set of T ⊥-lists) is spelled out underneath each update. I assume a model where Ann (a) has two friends (f1 and f2). One friend has won and is happy (f1), while Ann herself is not happy, perhaps because she wanted to win. In this model, (4a) is intuitively true, whereas (4b) is false. Formally, the UC representation (6a) yields a non-empty final output state (c4), whereas (6b) yields the abstract state (c′4 = ∅).

\[
\begin{align*}
\text{(5)} \quad &\{\langle \rangle, \langle \rangle\} \\
\text{(6a)} \quad &\{x \in \text{ann}; \quad [x; \text{friend}(x, \bot)]\; \{\text{win}(\top, \bot)]; \quad \text{happy}(\top, \bot)] \}
\end{align*}
\]

\[
\begin{align*}
&\{\langle \rangle, \langle \rangle\} \\
&\{\langle \langle f_1 \rangle, \langle a \rangle \rangle\} \\
&\{\langle \langle a \rangle, \langle f_1 \rangle \rangle\}
\end{align*}
\]

\[
\begin{align*}
\text{(6b)} \quad &\{x \in \text{ann}; \quad [x; \text{friend}(x, \bot)]\; \{\text{win}(\bot, \bot)]; \quad \text{happy}(\top, \bot)] \}
\end{align*}
\]

\[
\begin{align*}
&\{\langle \langle a \rangle, \langle \rangle \rangle\} \\
&\{\langle \langle a \rangle, \langle f_1 \rangle \rangle\} \\
&\{\langle \langle a \rangle, \langle f_1 \rangle \rangle\}
\end{align*}
\]

Stone and Hardt (1999) analyze so-called ‘sloppy identity’ as anaphora to a center-dependent antecedent plus center-shift. They argue that centering guides all types of anaphora, be it nominal (7a), modal (7b), or temporal (7c). Bittner (2001) adduces crosslinguistic evidence, including ambiguous topic-comment structures like Warlpiri (8), where the topic anaphor (ngula-ju) can refer to an individual (A), modality (B), or time (C). Building on these findings, I propose that illocutionary contrasts, e.g. assertion (9a) vs. question (9b), instantiate the centering top-bottom dichotomy in the modal domain.

\[
\begin{align*}
\text{a.} \quad &\text{Smith spent his paycheck. Jones saved it (= his paycheck).} \\
\text{b.} \quad &\text{All would use slides if he gave this talk. Bill would =n’t (if he gave this talk).} \\
\text{c.} \quad &\text{Back then you thought I was crazy. You still do (= think I am crazy).}
\end{align*}
\]

(8) Warlpiri (Hale 1976, p.c.)
Maliki-li kaji-ngki yarki-rni nyuntu ngula-ju kapi-rna luwa-rni.
[dog-erg cmp-3s.2s bite-npst you] that-top fut-1s.3s shoot-npst
A. That dog that bites you, I’ll shoot it.
B. If a dog bites you, I’ll shoot it.
C. When a dog bites you, I’ll shoot it.

\[
\begin{align*}
\text{(9) a.} \quad &\text{Aani ajugaa-pu-q.} \\
\text{Ann won.}
\end{align*}
\]

\[
\begin{align*}
\text{b.} \quad &\text{Aani ajugaa-pi-a? (Aap.)} \\
\text{Ann won-que-3s} \\
\text{Did Ann win? (Yes.)}
\end{align*}
\]
More precisely, I extend the default state (5) with modal referents. If the initial common ground is $p_0 = \{w_0, w_1\}$, the default state is (10). This state is induced by the very act of speaking up (‘commonplace effect’ of Stalnaker 1978). Suppose Ann won in $w_2$ and $w_2$ but not in $w_0$. Then both the assertion (9a) and the question (9b) are felicitous in this context.

$$\begin{align*}
(10) & \langle \langle w_0, p_0 \rangle, \langle \rangle \rangle \\
& \langle \langle w_1, p_0 \rangle, \langle \rangle \rangle
\end{align*}$$

I propose to analyze both as modal updates. Assertion (11a) reduces the common ground, i.e. the set of topic worlds, from $\{w_0, w_1\}$ in (10) to $\{w_1\}$ in $c_2$. It also introduces the set of surviving topic worlds as the new primary topic (top referent, $p_1 := \{w_1\}$, in $c_3$). In contrast, a question is a pure attention update (11b). That is, it does not reduce the common ground ($\{w_0, w_1\}$ in $c'_1$ through $c'_3$). Instead, the scope of the question (the proposition that Ann won, $p_1^* := \{w_1, w_2\}$) is added to the \bot-list. This induces a partition of the common ground into a yes-cell and a no-cell ($p_1 = \{w_2\}$ vs. $\{w_0\}$, adapting Hamblin 1973, and Groenendijk and Stokhof 1994). If the addressee answers Yes, then this assertion reduces the common ground to the yes-cell ($c'_4$) and introduces this modality as the new primary topic ($p_1 := \{w_1\}$ in $c'_3$). Thus, a question+yes answer updates information and the primary topic like a plain assertion, but questions introduce additional modal referents (e.g. $p_1^*$ in $c'_3$).

\begin{align*}
(11a) \quad & \langle x, x = \text{ann} \rangle; \quad [\text{win}_{win} \langle \top \delta \rangle]; \quad \langle \langle p_1, p = \top \omega \rangle \rangle \\
& \langle \langle a, w_0, p_0 \rangle, \langle \rangle \rangle; \quad \langle \langle a, w_1, p_0 \rangle, \langle \rangle \rangle; \quad \langle \langle \langle a, a, w_1, p_0 \rangle, \langle p_1^*, \omega \rangle \rangle \rangle \quad \langle \langle a, w_1, p_0 \rangle, \langle \rangle \rangle
\end{align*}

\begin{align*}
(11b) \quad & \langle x, x = \text{ann} \rangle; \quad [w] \quad \langle \text{win}_{\text{win}} \langle \top \delta \rangle \rangle; \quad \langle \langle p_1, p = \bot \omega \rangle \rangle \\
& \langle \langle a, w_0, p_0 \rangle, \langle \rangle \rangle; \quad \langle \langle a, w_0, p_0 \rangle, \langle w_1 \rangle \rangle; \quad \langle \langle a, w_0, p_0 \rangle, \langle p_1^*, w_1 \rangle \rangle \quad \langle \langle a, w_0, p_0 \rangle, \langle w_2 \rangle \rangle; \quad \langle \langle a, w_0, p_0 \rangle, \langle p_1^*, w_2 \rangle \rangle \quad \langle \langle a, w_1, p_0 \rangle, \langle \rangle \rangle; \quad \langle \langle a, w_1, p_0 \rangle, \langle w_1 \rangle \rangle; \quad \langle \langle a, w_1, p_0 \rangle, \langle p_1^*, w_1 \rangle \rangle \quad \langle \langle a, w_1, p_0 \rangle, \langle w_2 \rangle \rangle; \quad \langle \langle a, w_1, p_0 \rangle, \langle p_1^*, w_2 \rangle \rangle
\end{align*}

This has implications for modal anaphora. For example, assuming that a conditional gets its modal base by anaphora (Kratzer 1981, Stone 1997), we correctly predict that the antecedent can be a question (12a), or another source of a propositional referent (e.g. (12b, c)).

\begin{itemize}
  \item a. *(Did Oswald shoot Kennedy?)* Well, *if* he had, someone would’ve seen him. So I don’t believe it.
  \item b. Oswald did *not* shot Kennedy. *If* he had, someone would’ve seen him.
  \item c. Kennedy was shot *because* he had enemies. *If* Oswald hadn’t shot him, someone else would have.
\end{itemize}

[<Linguistische Arbeiten: Musterseiten Sammelband>]
In what follows I formally define Update with Modal Centering ($\text{UC}_\omega$) and DRT-style abbreviations used above (Section 2.3). I then extend $\text{UC}_\omega$ with temporal referents so that we can represent centering-based anaphor across domains (Section 2.4).

### 2.2 Update with Modal Centering ($\text{UC}_\omega$)

**Update with Centering (UC)** is an update system designed to represent centering-based discourse anaphora and to allow direct type-driven composition. To accomplish these goals, UC combines type logic (adapting Muskens 1995, 1996) with update semantics (adapting Veltman 1996). That is, the meaning of a sentence updates an input state of information to the output state. Centering is analyzed as list-based anaphora (adapting Dekker 1994). More precisely, a state of information is a set of $\top$-lists of ranked semantic objects that are available for anaphoric reference (discourse referents). Each $\top$-list is a pair of two sequences of objects: a $\top$-list, representing ranked referents for top-anaphors (e.g. ‘3s’), and a $\bot$-list, representing ranked referents for bottom anaphors (e.g. ‘3s’).

**Definition 1 (lists and info-states)** Given a non-empty set $D$ of objects:

- $D^{n,m} = D^n \times D^m$ is the set of $\top$-lists of $n$ $\top$-objects and $m$ $\bot$-objects.
- For any $\top$-list $i \in D^{n,m}$, $\top i := i_1$ and $\bot i := i_2$. Thus, $i = (\top i, \bot i)$.
- An $(n, m)$-info-state is any subset of $D^{n,m}$. The empty set, $\emptyset$, is the absurd state.

$\text{UC}_\omega$ represents discourse reference to *individuals* ($\delta$), *worlds* ($\omega$), and *propositions* ($\Omega \equiv \omega \delta$). That is, a non-empty $\top$-list consists of semantic objects of these types. A $\top$-list is itself a semantic object (of type $s$), but not a discourse referent ($s \notin \text{DR}(\Theta)$).

**Definition 2** ($\text{UC}_\omega$ types). The set of $\text{UC}_\omega$ types $\Theta$ is the smallest set such that (i) $\delta, \omega, t, s \in \Theta$, and (ii) $(ab) \in \Theta$ if $a, b \in \Theta$. The subset $\text{DR}(\Theta) = \{ \delta, \omega, \alpha \}$ is the set of discourse referent types within $\Theta$.

In $\text{UC}_\omega$-frames, $D_\theta$ is the domain of $\top$-lists. It consists of all the pairs of sequences of objects of referent types ($\text{DR}(\Theta) = \{ \delta, \omega, \alpha \}$), including the empty $\top$-list, $\langle \rangle, \langle \rangle$. A model for $\text{UC}_\omega$ consists of a $\text{UC}_\omega$-frame and an interpretation of non-logical constants.

**Definition 3** ($\text{UC}_\omega$ frames). A $\text{UC}_\omega$ frame is a set $\{ D_a | a \in \Theta \}$ of non-empty pairwise disjoint sets $D_a$ such that (i) $D_\emptyset = \{ 1, \emptyset \}$, (ii) $D_{ab} = \{ f | \emptyset \subset \text{Dom} f \subseteq D_a \text{ and } \emptyset \subseteq D_b \}$, and (iii) $D_i = \cup \{ D^{n,m} \mid 0 \leq n \leq 0 \leq m \}$, where $D = \cup \{ D_a | a \in \text{DR}(\Theta) \}$.

**Definition 4** ($\text{UC}_\omega$ models). A $\text{UC}_\omega$ model is a pair $M = \langle D_a | a \in \Theta \rangle, \llbracket \cdot \rrbracket \rangle$ such that $\{ D_a | a \in \Theta \}$ is a $\text{UC}_\omega$ frame and for all $A \in \text{Con}_{\omega}, \llbracket A \rrbracket \in D_a$.

The basic terms of $\text{UC}_\omega$ are variables and non-logical constants. The syntactic definition ($\text{D5}_\omega$) builds complex terms by means of six standard rules of type logic (i–vi) and three centering rules (vii–ix). The centering rule (vii) combines a referent-variable valued and a $\top$-list into an extended $\top$-list. Rule (viii) builds local anaphors (e.g. $\top a_n$ for the $n$th
object of type $a$ on the $\top$-list of the input $\bot$-list). Finally, rule (ix) builds global anaphors (e.g. $\tau_a\{u_a\}$ for the entire set of $\tau_a$-objects on all the $\bot$-lists of the input state $I$). For any assignment $g$, UC$_a$ semantics (D6$_a$) extends the interpretation of constants, $[\cdot]$, to all terms, $[\cdot]^g$. Rules (i-vi) are standard. (We write '$X = Y$' for '$X$ is $Y$ if $Y$ is defined, else $X$ is undefined'. We also use the von Neumann definition of truth values, so $1 := \{\emptyset\}$ and $0 := \emptyset$.) In the centering rule (vii), $(d \oplus z) := \langle d, z_1, \ldots, z_n \rangle$ for any object $d$ and sequence $z$.

That is, the object $g(u_a)$ is added to the specified sublist of the input $\bot$-list $[B]^g$. In (viii), $(z)_n$ denotes the $n$th coordinate of $z$, and $(z)_n$, the sub-sequence of type $a$ coordinates of $z$.

That is, $\tau_a$ (or $\bot_a$) denotes the $n$th $a$-object on the $\top$-list (or $\bot$-list), if there is such an object, and fails to denote otherwise. Finally, rule (ix) says that $\{A\}$ denotes the global value of the anaphor $A_{\tau_a}$ in state $B_{\tau_a}$, i.e. (the characteristic function of, $\langle i \rangle$) the set of all the $A$-objects on all the $\top$-lists in (the set characterized by, $\langle i \cdot \rangle$) $B$ (adapted van den Berg 1996).

**Definition 5.** (UC$_a$-syntax). For any type $a \in \Theta$, define the set of $a$-terms, Term$_a$:

- $\text{Con}_a \cup \text{Var}_a \subseteq \text{Term}_a$
- $\lambda u_a(B) \in \text{Term}_a$ if $u_a \in \text{Var}_a$ and $B \in \text{Term}_a$
- $BA \in \text{Term}_a$, if $B \in \text{Term}_a$ and $A \in \text{Term}_a$
- $(A = B) \in \text{Term}_a$, if $A, B \in \text{Term}_a$
- $(\neg \varphi, \varphi \to \psi, (\varphi \land \psi), (\varphi \lor \psi) \in \text{Term}_a$, if $\varphi, \psi \in \text{Term}_a$
- $\forall u_a, \varphi \in \text{Term}_a$, if $u_a \in \text{Var}_a$ and $\varphi \in \text{Term}_a$
- $(u_a \oplus B, (u_a \oplus B) \in \text{Term}_a$, if $a \in \text{DR}()$, $u_a \in \text{Var}_a$, and $B \in \text{Term}_a$

**Definition 6.** (UC$_a$ semantics). For any $M = \langle \{D_a\} a \in \Theta, [\cdot] \rangle$ and $g$:

- $[A] = g(A)$ if $A \in \text{Con}_a$
- $[\lambda u_a(B)]^g(d) = [B]^g[u_a/d]$ if $d \in D_a$
- $[BA]^g = [B]^g[A]^g$
- $[-\varphi] = \langle [\cdot] \rangle$
- $[\varphi \to \psi] = \langle [\cdot] \rangle$
- $[\varphi \land \psi] = \langle [\cdot] \rangle$
- $[\varphi \lor \psi] = \langle [\cdot] \rangle$
- $[\forall u_a, \varphi] = \langle [\cdot] \rangle$
- $[\exists u_a, \varphi] = \langle [\cdot] \rangle$
- $[u_a \oplus B]^g = \langle [\cdot] \rangle$
- $[\tau_a] = \langle [\cdot] \rangle$
- $[A\{B\}]^g = \langle [\cdot] \rangle$ if $i \in D_a$
- $[\bot_a\{B\}]^g = \langle [\cdot] \rangle$ if $i \in D_a$

[Linguistische Arbeiten: Musterseiten Sammelband]
A context of utterance is a pair of a non-empty set of worlds (p₀, initial common ground) and an individual who is known to be speaking (the speaker, denoted by the δ-constant 1 and constrained by the ωθ-predicate speak). The common ground determines the default state, p₀. By default, the common ground p₀ is the topical proposition, i.e. the ΘΩ₁-object. Moreover, for each common ground world (candidate for the speech world), there is some θ₁-list in the default state where that world is the local topic world, i.e. the Θα₁-object.

**Definition 7 (contexts and defaults).** For a model M = ⟨{D}

For the sake of readability and introduce the content of what is said updates the default state. For any input state of information c (set of θ₁-lists), a term φ of type (st)st (representation of a sentence) is assigned a truth value just in case it updates the primary topic to a proposition (TOPM,c ϕ = {p}). In that case, the topical proposition is the set of worlds where φ is true; in all other worlds, φ is false.

**Definition 8 (topic-set, truth).** For a model M, info-state c, and (st)st term φ.

i. TOPM,c ϕ = {⟨T⟩} ∈ D

ii. φ is true relative to M and c at world w iff ∃p ∈ D: TOPM,c ϕ = {p} ∧ w ∈ {p}

iii. φ is false relative to M and c at world w iff ∃p ∈ D: TOPM,c ϕ = {p} ∧ w ∈ {p}

2.3 DRT-style abbreviations

For the sake of readability, we follow the usual practice (Muskens 1996, Stone 1997, a.o.) and introduce a system of DRT-style abbreviations. For example, in section 2.1 we used some abbreviations defined in Table 1. Further abbreviations will be introduced as needed.

Table 1. Drt-notation for UC(ω₁)-terms

<table>
<thead>
<tr>
<th>Static relations (a ∈ DR(Θ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>A₁ ∈ B₁</td>
</tr>
<tr>
<td>A₁ ∈ B₁</td>
</tr>
<tr>
<td>A₁ ⊆ B₁</td>
</tr>
<tr>
<td>B(A₁, ..., Aₙ)</td>
</tr>
<tr>
<td>* Local projections, conditions, and updates (a ∈ DR(Θ), R ∈ {..., ∈, ∈, ∈})</td>
</tr>
<tr>
<td>T A₁, ⊥ A₁</td>
</tr>
<tr>
<td>A₁c, A₁c</td>
</tr>
<tr>
<td>B[u] A</td>
</tr>
<tr>
<td>B[u₁,...,un] A</td>
</tr>
<tr>
<td>[C]</td>
</tr>
<tr>
<td>[u₁,...,un] C</td>
</tr>
<tr>
<td>[u₁,...,un] C</td>
</tr>
</tbody>
</table>

[Linguistische Arbeiten: Musterseiten Sammelband]
• global updates \( (a \in \text{DR}(\Theta), \ R \in \{=, \in, \notin, \subseteq\}) \)

\[
\begin{align*}
[ARB]\forall & \quad \lambda\lambda\lambda_{\alpha\beta\gamma} \ A_j \wedge A_j B (\{\}) \\
[\{\}] & \quad \lambda\lambda\lambda_{\alpha\beta\gamma} \ A_j \wedge A (\{\}) \ R B (\{\}) \\
\exists u & \quad \lambda\lambda\lambda_{\alpha\beta\gamma} \ \exists u_\alpha \exists u_\beta \exists u_\gamma (u \wedge \alpha \wedge \beta) \\
\exists u & \quad \lambda\lambda\lambda_{\alpha\beta\gamma} \ \exists u_\alpha \exists u_\beta \exists u_\gamma (u \wedge \alpha \wedge \beta) \\
(\lambda\lambda\lambda_{\alpha\beta\gamma} \ A_j) & \quad \lambda\lambda\lambda_{\alpha\beta\gamma} \ (K(J))
\end{align*}
\]

By way of illustration, consider again the representations of assertions and question-answer pairs proposed in (11a, b). The proposed UC\(_m\) representations, in the above dart-notation, are repeated in (13) and (14) together with the glosses of the respective examples:

(13) Ann win-DEC-3S
\[\tau[x; x = i; ann]; \ [\text{win}_{\text{an}}(\tau \delta)]; \ [p; p = \top \omega] \]

(14) Ann win-QUE-3S?
\[\tau[x; x = i; ann]; \ [w; \text{win}_{\text{an}}(\tau \delta)]; \ [p; p = \bot \omega]; \ [\top \omega \in; \bot \Omega]; \ [\tau[p; p = \top \omega]] \]

In the case of assertion (13), the first box adds Ann to the \(\tau\)-list (15). The second box tests that this topical individual (\(\tau \delta\)) won in the local topic world (\(\tau \omega\)), reducing the common ground (\(\tau \omega\)) to the worlds that pass this test (16). The last box introduces the updated common ground as the new primary topic (17). The truth definition (18) then correctly predicts that assertions have truth values and assigns the correct truth condition.

(15) \(\{\theta\}_p \in [x; x = \{\}]^{\tau} \equiv \text{c}_1\)
\[
\begin{align*}
\tau[(a, w, p_0), (\langle \rangle)] & \quad \in 0 \ p_0 \ & a = \{[a]\}
\end{align*}
\]

(16) \(c_1 \in [\text{win}_{\text{an}}(\tau \delta)]^{\tau} \equiv \text{c}_2\)
\[
\begin{align*}
\tau[(a, w, p_0), (\langle \rangle)] & \quad \in 0 \ p_0 \ & a = \{[a]\}
\end{align*}
\]

(17) \(c_2 \in [p; p = \top \omega]^{\tau} \equiv \text{c}_3\)
\[
\begin{align*}
\tau[(a, w, p_0), (\langle \rangle)] & \quad \in 0 \ p_0 \ & a = \{[a]\}
\end{align*}
\]

In the related question (14), the first update is again (15) (hence \(\text{c}_2 = \text{c}_3\)). However, the other two boxes are pure attention updates. Both add modal referents to the \(\perp\)-list: first, all of the possible worlds where Ann wins (18), and then, the entire set of these worlds, i.e. the proposition that Ann won (19).

(18) \(c_2 \in [w; \text{win}_{\text{an}}(\tau \delta)]^{\tau} \equiv \text{c}_2'\)
\[
\begin{align*}
\tau[(a, w, p_0), (\langle \rangle)] & \quad \in 0 \ p_0 \ & a = \{[a]\}
\end{align*}
\]

[ Linguistische Arbeiten: Musterseiten Sammelband]
This analysis captures the intuition that a question adds no information (i.e. does not reduce the common ground), and that the issue of truth value does not arise (given the truth definition D8). In contrast, the answer to a question is informative and does have a truth value. In the present theory, this is because the answer reduces the common ground (20) and introduces the updated common ground as the new primary topic (21). The relation of an elliptic answer to the question we define is analyzed as centering-based modal anaphora.

In what follows UC\textsubscript{\textit{w}} serves to represent nominal and modal reference in discourse. To factor in temporal reference we define an extension of this update system.

### 2.4 General Update with Centering (UC)

General \textit{Update with Centering}, UC, extends UC\textsubscript{\textit{w}} with three types of discourse referents: events (\textit{e}), states (\textit{\sigma}), and times (\textit{t}).

**Definition 2** (UC types). The set of UC types \( \Theta \) is the smallest set such that (i) \( \delta, e, \sigma, t, a, i, s \in \Theta \), and (ii) \( (ab) \in \Theta \) if \( a, b \in \Theta \). The subset \( \text{dr}(\Theta) = \{ \delta, e, \sigma, t, a, \omega, \alpha \} \) is the set of discourse referent types within \( \Theta \).

UC-terms are interpreted on the same names as UC\textsubscript{\textit{w}} (D3 in Section 2.2), but in richer models. In natural language discourse time behaves like a chain of discrete instants (see Kamp 1979, Bittner 2008, a.o.). For simplicity, I model discourse time using integers (as in D4.ii). A \textit{discourse instant} is a set of one integer (e.g. \{3\}), whereas a \textit{discourse period} is a set of successive integers (e.g. \{4, 5\}). A discourse time \( t \) \textit{precedes} \( t' \), written \( t < t' \), if every integer in \( t \) precedes every integer in \( t' \). In addition, UC has a set of time-related logical operators (see D4.iii). First of all, for any world \( w \), the \textit{run time} operator \( \theta \) maps any eventuality in \( w \) to its run time in \( w \). If the eventuality is an event, then its run time in any
world is a discourse instant, \( \{n\} \), and its consequent state (CON) begins at the next instant, \((n + 1)\). If the eventuality is a state, then its run time in any world is a discourse period, and its beginning (BEG) and end (END) are events that begin and end that period. Some eventualities have a central individual (CTR). In particular, verbal predicates of type \( a_\emptyset \ldots t \), where \( a \in \{ e, \sigma \} \) center their eventuality argument on their first individual argument. Eventuality-valued operators (CON, BEG, END) preserve this nominal centering. In addition, some eventualities may have a contrasting background individual (BCK).

**Definition 4 (UC models)** A UC model is a triple \( M = \langle \{D_o\} a \in \Theta, \langle \cdot \rangle \rangle \) such that:

(i) \( \{D_o\} a \in \Theta \) is a UC frame, (ii) \( D_i \) is the set of non-empty convex sets of integers and \( \forall t, t' \in D_i; t < t' \) iff \( \forall n \in t \forall n' \in t'(n < n') \), and (iii) \( \langle \cdot \rangle \) assigns to each \( A \in CON_a \) a value \( \{A\} \in D_o \) and to each \( B \in \{CON, BEG, END, CTR, BCK, \emptyset\} \), a value \( \{B\} \) such that:

\[
a. \quad \{CON\} \in D_{o\alpha} \quad \{\emptyset\} \in \{f_e \cup f_o | f_e \in D_{o\alpha} \cup f_o \in D_{o\alpha}\}
\]

\[
b. \quad \forall t \in D_o, w \in D_{o\alpha}, d \in D_{o\alpha}, e \in D_{o}, s \in D_{o\alpha} ev \in D_i \cup D_o;
\]

\[
\emptyset)(w, e) = \exists \forall (t \in \{n\} \& \emptyset)(\{CON(e)\}) = \{(n + 1)\}
\]

\[
\emptyset)(w, s) = \exists \forall (t \in \{MIN \} \& \emptyset)(\{CON\}) \leq \{(MAX \} \& \emptyset)(\{END\})
\]

\[
\emptyset)(w, d) = \exists \forall (t \in \{CTR\}(\emptyset) \leq \{(STR\}(\emptyset))
\]

The syntactic and semantic definitions of UC include three extra rules (x–xii), which introduce and interpret time-related logical constants.

**Definition 5 (UC syntax).** Rules (i–ix) as in Definition 5x

x. \( (A \subset B), (A < B) \in \text{Term}_e \) if \( A, B \in \text{Term}_e \)

xi. \( \text{CON} A \in \text{Term}_e \) if \( A \in \text{Term}_e \)

\( \text{BEG} A, \text{END} A \in \text{Term}_e \) if \( A \in \text{Term}_e \)

\( \text{CTR} A, \text{BCK} A \in \text{Term}_e \) if \( A \in \text{Term}_e \)

\( \emptyset \emptyset A \in \text{Term}_e \) if \( W \in \text{Term}_e \) and \( A \in \text{Term}_e \)

**Definition 6 (UC semantics).** Rules (i–ix) as in Definition 6x

x. \( [A \subset B]^\emptyset = 1 \) if \( \emptyset \langle [A]^\emptyset, [B]^\emptyset \rangle \in D_i \) and \( [A]^\emptyset \subset [B]^\emptyset \)

\( [A < B]^\emptyset = 1 \) if \( \emptyset \langle [A]^\emptyset, [B]^\emptyset \rangle \in D_i \) and \( [A]^\emptyset \subset [B]^\emptyset \)

xi. \( [BA]^\emptyset \equiv [B][\{A\}]^\emptyset \) if \( B \in \{\text{CON}, \text{BEG}, \text{END}, \text{CTR}, \text{BCK}\} \)

xii. \( [\emptyset \emptyset A]^\emptyset \equiv [\emptyset \emptyset \{[W]^\emptyset \}]^\emptyset \) if \( B \in \{\text{CON}, \text{BEG}, \text{END}, \text{CTR}, \text{BCK}\} \)

In UC an (utterance) context is a pair of a non-empty common ground, \( p_o \), and a speech event, \( e_o \), realized throughout \( p_o \) at a particular instant. A context induces a default state (‘commonplace effect’ of Stalnaker 1978): the common ground \( p_o \) determines the default modal topics, whereas the speech event \( e_o \) determines the default topical periods. The modal defaults are the same as in UCx. In the temporal domain, the speech instant is the default topic time, and the speech event itself, the default perspective point (e.g. for indexicals, adapting Kaplan 1978). The truth definition for UC is the same as for UCx (i.e. D8).
DEFINITION 7 (utterance context, default state). For a model $M = (\{D_a\} \ a \in \Theta), <_{\gamma}, [\cdot])$,

i. an $M$-(utterance) context is a pair $(p_0, e_0) \in D_{\text{in}} \times D_{\text{tr}}$ such that (a) $\gamma p_0 \neq \emptyset$, and

(b) $\exists w \in \{p_0 \in [\cdot]](w, e_0) \& (e_0, [\text{CTR}](e_0)) \in [\cdot]](w)$

ii. $\gamma (p_0, e_0) = \{\{w \in \{p_0 \in [\cdot]](w, e_0), (\cdot)\} \mid w \in \{p_0 \& t_0 = [\cdot]](w, e_0)\}$

In the following analysis of Kalaallisut discourse, we systematically first use UC$_0$ to analyze modal reference and then the full UC, to factor in temporal reference. We begin with fact-oriented moods (Section 3) and successively add attitudes (Section 4), hypothetical mood (Section 5), modal remoteness (Section 6), and direct composition (Section 7).

3 Fact-oriented moods

3.1 Observations

Kalaallisut verbs inflect for matrix mood (22) or dependent mood (23). Matrix moods are illocutionary. A matrix ‘verb’ is a complete sentence, classified by the mood inflection as an assertion about the topic (declarative, DEC), question about the topic (interrogative, QUE), wish concerning the topic (optative, OPT), or directive to the addressee (imperative, IMP). Dependent moods classify the dependent verb, in relation to the matrix, as a background fact (FCT), hypothesis (HYP), elaboration (ELA), or habit (HAB). They also mark the centering status of the dependent subject as either topical (e.g. -FCT$_T$) or backgrounded (e.g. -FCT$_B$), i.e., anaphoric or in contrast to the matrix subject, which is always topical.

(22) Matrix moods

a. (*Aqagu) uterpoq.

(*aqagu) utir-pu-q

(*tomorrow) return-DEC$_s$-3S

He$_s$ has returned (*tomorrow).

b. (*Aqagu) uterpa?

(*aqagu) utir-pi-a

(*tomorrow) return-QUE-3S

Has he$_s$ returned (*tomorrow)?

c. (Aqagu) uerli!

(aqagu) utir-li

(tomorrow) return-OPT-3S

May he$_s$ return (tomorrow)!

d. (Aqagu) uerina!

(aqagu) utir-gi-ia

(tomorrow) return-IMP-2S

Return (tomorrow)!

(23) Dependent moods (sample)

a. (*Aqagu) [uterumi | utermat] nuannaarpug.

(*aqagu) [utir-ga-ni | utir-mm-at] nuannaar-pu-q

(*tomorrow) [return-FCT$_s$-3S$_s$ | return-FCT$_s$-3S$_s$] happy-DEC$_s$-3S

Because/when {he$_s$ | he$_s$} returned (*tomorrow), he$_s$ was happy.


aqagu [utir-gu-ni | utir-pp-at] nuannaar-ssa-pu-q

tomorrow [return-HYP$_s$-3S$_s$ | return-HYP$_s$-3S$_s$] happy-exp$^+$-DEC$_s$-3S

If/when {he$_s$ | he$_s$} returns tomorrow, he$_s$’ll be happy. (lit. is expected to)
Most Kalaallisut moods are either fact-oriented (DEC, QUE, FCT) or prospect-oriented (OPT, IMP, HYP). As (22)–(23) illustrate, prospect-oriented moods introduce future eventualities and allow future location times, whereas fact-oriented moods rule out future location times. Discourse-initially, fact-oriented moods require the state-equivalent (i.e. the state itself or the consequent state of an event) to hold at the speech instant (24a, b). If the topic time is not an instant but a period, then fact-oriented moods require the event-equivalent (i.e. the event itself or the beginning of a state) to fall within that period (see (25)–(26)). In addition, at any point in discourse, fact-oriented moods constrain the event-equivalent of the last eventuality of the verbal base to be a currently verifiable fact from the perspective of the speech act, i.e. to precede the speech act in the speech world. Note that in (23b), the last eventuality of the base is the state of expectation introduced by the attitudinal suffix -ssa ‘exp’", not the future eventuality introduced by the root (see also Bittner 2005, 2008).

(24) a. **Ulapippunga.**

       ulapik-\(\text{pu}\)-nga
       busy-DEC\(_0\)-1S

       I am busy.

b. **Uterpunga.**

       utir-\(\text{pu}\)-nga
       return-DEC\(_0\)-1S

       I have returned.

(25) a. **Ullumi ulapippunga.**

       ullumi ulapik-\(\text{pu}\)-nga
       today busy-DEC\(_0\)-1S

       I’ve been busy today. (**NOT:** I am busy (later) today.)

b. **Ullumi uterpunga.**

       Ullumi utir-\(\text{pu}\)-nga.
       today return-DEC\(_0\)-1S

       I returned today. (**NOT:** I return today.)

(26) **Ole nuamarpoq Aani ullumi utermat.**

       Ole nuamaar-\(\text{pu}\)-q Aani ullumi utir-\(\text{mm}\)-at.

       Ole happy-DEC\(_0\)-3S Ann today return-FCT\(_0\)-3S.

       Ole is happy because Ann returned today. (**NOT:** …because Ann returns today.)

**DEFINITION** (currently verifiable fact). From the perspective of an event \(e_0\), an event \(e\) is a currently verifiable fact iff \(e\) occurred in the same world as \(e_0\) prior to \(e_0\).

**OBSERVATION 1.** Fact-oriented moods constrain the event-equivalent of the last eventuality of the verbal base to be a currently verifiable fact from the perspective of the speech event.
The current verifiability requirement of Kalaallisut fact-oriented moods makes them unlike the English indicative mood. For example, in contrast to the ungrammatical Kalaallisut declarative (22a), the English non-past indicative can refer to the future, e.g. in *I return tomorrow*. The English past indicative can refer to what is possible rather than what is, e.g. in *If Oswald didn’t kill Kennedy, someone else killed him*. In contrast, the Kalaallisut declarative (27) is ungrammatical: a hypothetical murder is not a currently verifiable fact. All that can be verified now is a state of expectation or belief (recall -ssa ‘-exp’ in (2)).

(27) *Oswaldip Kennedy toquisimangippagu Oswald-p Kennedy tuquisima-nngit-pp-a-gu
Oswald-ERG Kennedy kill-prf-not-HYP₁,-3S₁,-3S

\[\text{inupilogataata toquisimavaa.} \]
\[\text{inuk-piluk-qat-ata tuquisima-pa-a} \]
man-bad-other-3S₁,ERG kill-prf-DEC₁,-3S,3S

(NOT: If Oswald didn’t kill Kennedy, then someone else killed him.)

While ruling out future reference, fact-oriented moods allow negation. Kalaallisut expresses negation by means of a derivational suffix -nngit ‘not’. The derivational status of this suffix is shown by the fact that it allows further derivation (e.g. in (28iii)). The negation -nngit also allows state-modifiers (e.g. ‘long-MOD’, ‘still’), which show that it introduces a state (like the root ‘asleep’). Finally, compatibility with fact-oriented moods (i) and their elaborations (ii) shows that negative states can be currently verifiable facts.

(28) i. *Ullumi sivisuumik {makinngila-| sinippu-| *makkippu-}\text{-nga.}
\[\text{ullumi sivisaqq-mik {makik-nngit-la-| sinik-pu-| *makik-pu-}\text{-nga.} \]
today long-MOD \{get.up-not-DEC- | asleep-DEC₁- | *get.up-DEC₁\}-1S
Today I’ {stayed in bed | slept | *got up} a long time.

\[\text{ii. Suli {makinngit-| sinit-| *makit-}\text{-tunga Ole iserpoq,} \]
suli {makik-nngit-| sinik-| *makik-}\text{-tu-nga Ole isir-pu-3q}
still \{get.up-not- | asleep- | *get.up\}-ELA₁,-1S Ole enter-DEC₁,-3S

While I’ was still \{in bed | asleep | *\ldots\} Ole’ dropped in.

\[\text{iii. Nuilani aamma suli {makinngin-| sinin-| *makin-}\text{-nerarpaa.} \]
mulia-ni aamma suli {makik-nngit-| sinik-| *makik-\text{-nirar-pa-a} \]
wife-3S₃ also still \{get.up-not- | asleep- | *get.up\}-say₁,-DEC₁,-3S,3S
He, said that his \(_r\) wife too was still \{in bed | asleep | *\ldots\}.

I propose that the current verifiability constraint of fact-oriented moods has two components: modal and temporal. Modally, the matrix declarative mood (DEC) locates the matrix eventuality throughout the output common ground (main fact), whereas the dependent factual mood (FCT) locates the subordinate eventuality throughout a superset of the common ground (background fact). Thus, both eventualities are realized in every live candidate for the speech world, so they can be verified in that world. Temporally, the declarative matrix mood locates the matrix event-equivalent (EVT) before the speech act. That is, from the perspective of the speech act this event is a currently verifiable fact. The dependent factual mood locates the matrix EVT within the consequent state of the subordinate EVT. Thus, the
subordinate EVT is verifiable from the matrix EVT, whose temporal location within the consequent state further suggests a causal link. It does not entail it because post hoc is not necessarily proper proter hoc. But whether or not the (real) subordinate EVT caused the (real) matrix EVT, neither EVT can be located in the future of the speech act.

To make this proposal precise, I first formalize the modal notion of a verifiable fact (Section 3.2) and then, the temporal modifier currently (Section 3.3).

3.2 Verifiable facts

The Kalaallisut discourse (29i, ii) illustrates typical use of fact-oriented moods (DEC, FCT) and their interaction with negation (-nngit ‘not’). The proposed representation of this discourse in UCω is given in (30i, ii).

(29) i. Ole iserpoq. ii. Nuannaammilaq nulani naparsimmammat.

Ole enter-DECτ-3S happy-not-DEC-3S wife-3Sτ ill-FCT,3S⊥

Ole′ has dropped in. He′s not happy, because his wife′ is ill.

(30) i. T[x | x = ω ole]; enterω(τ δ); T[p | p = τ α]|]

ii. [w | happyω(τ δ); [ τ α ∈ ⊥α]|]; T[p | p = τ α]|]; [x w | wifeω(x, τ δ)]; [ill⊥ω(⊥δ)];

[τ α] ⊆ ⊥α]

In (30i), the first box adds Ole to the τ-list, while the next two boxes comment on this topic. The verbal root adds the information that the topic (Ole) entered in the local topic world (τ α). This reduces the common ground (τ α)) to the worlds where this is the case. The declarative mood introduces the updated common ground as the new primary topic. This is the new topical proposition and the truth-set of the declarative sentence (29i).

In (30ii) the first three boxes represent the negated declarative matrix of (29ii) (‘happy-not-DEC-3S’). The scope of negation adds to the ⊥-list all the worlds where the topical individual (Ole) is happy. The negation asserts that the world of evaluation is not in this set (⊥α). The declarative mood identifies the world of evaluation as the topical speech world (τ α), and introduces the set of surviving topic worlds (τ α) as the new primary topic. That is, in the context of (29i), the truth-set of the negated declarative matrix of (29ii) is the set of worlds (where this speech act takes place and) where Ole has entered unhappy.

The post-posed factual dependent (FCT) introduces a background fact that may have caused this matrix fact. In (30ii) the factual dependent is represented by the last three boxes. The entire sequence introduces into the background the proposition that Ole has a sick wife (⊥α). The factual mood adds that this background proposition is a fact (i.e. true) throughout the matrix common ground (Τ α)). This suggests that it may be a cause of the matrix fact (i.e. that Ole has entered unhappy in the world of the current speech act).

This suggestion is reinforced by temporal anaphora, which locates the beginning of Ole′s unhappy state within the consequent state of the beginning of his wife′s illness. This temporal relation is discussed in the next section, which explicates current verifiability.
3.3 Current verifiability

In what follows, \( e \) is a variable of type \( \varepsilon \) (event), \( s \) of type \( \sigma \) (state), and \( t \) of type \( \tau \) (time). Time-related dt-notation is defined in Table 2.

**Table 2 dt-abbreviations for time-related UC-terms**

<table>
<thead>
<tr>
<th>static relations and operations</th>
<th>( t \leq t' ) for ( t \subset t' \cup t = t' )</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVT ( e ) for ( e )</td>
<td>EVT ( s ) for ( \text{BEG} \ s )</td>
</tr>
<tr>
<td>STA ( e ) for ( s )</td>
<td>STA ( e ) for ( \text{CON} \ e )</td>
</tr>
</tbody>
</table>

* related dt-abbreviations \( (a \in \text{DR}(\Theta), R \in \{=, \leq, <, \leq, <\}) \)

\[ B_{\alpha} A_{\beta} \quad \text{for} \quad \lambda i, \lambda A \quad \text{for} \quad \lambda i, \lambda A, \eta_i, \eta_i R \eta_i B^i \]

\[ [\text{AT}_W\{A, T\}] \quad \text{for} \quad \lambda j, \lambda i, (i \land (\exists j, i \land \theta_i \text{EVT} A_i \subset T_i) \rightarrow \theta_i \text{EVT} A j \subset T j) \land (\neg \exists j, i \land \theta_i \text{EVT} A_i \subset T_i) \rightarrow \neg (T j \subset \theta_i \text{STA} A j) \]

The global \( \text{AT} \)-update, \( [\text{AT}_W\{A, T\}] \), provides a unified representation for the two temporal patterns found with fact-oriented moods in Kalaallisut. Recall that by discourse-initial default, a currently verifiable state holds now (31a), whereas a currently verifiable event has a consequent state that holds now (31b). Other topic times can be set, if the current verifiability requirement of the fact-oriented mood can be met (32a, b).

(31)  
\[ \text{a. Ulapik-} pu\text{-nga.} \]  
\[ \text{busy-DEC}_{\tau} 1S \]  
I am busy.

\[ \text{b. Utir-} pu\text{-nga} \]  
\[ \text{return-DEC}_{\tau} 1S \]  
I have returned.

(32)  
\[ \text{a. } \{\text{Ullumi} \mid *\text{aqagu}\} \] ulapik-nga.  
{today \mid *tomorrow} busy-DEC\(_{\tau}\) 1S  
I’ve been busy {today \mid *tomorrow}.

\[ \text{b. } \{\text{Ullumi} \mid *\text{aqagu}\} \] utir-nga.  
{today \mid *tomorrow} return-DEC\(_{\tau}\) 1S  
I returned {today \mid *tomorrow}.

I propose to represent the default pattern (31a, b) as in (33a, b). These UC representations are interpreted relative to the default state, where the topic time (\( \tau \)) is the speech instant. Since an instant (unit set) cannot properly include anything, the global \( \text{AT} \)-updates reduce to (34a, b).

(33)  
\[ \text{a. } [s] \text{busy}_{\tau_0}(s, \text{CTR} \tau \varepsilon) \mid [\text{AT}_{\tau_0} \{\perp \sigma, \tau \varepsilon\}] \mid [\text{EVT} \perp \sigma \subset \tau_0 \tau \varepsilon] ; \tau[p] p = \tau \omega |] \]

\[ \text{b. } [e] \text{return}_{\tau_0}(e, \text{CTR} \tau \varepsilon) \mid [\text{AT}_{\tau_0} \{\perp e, \tau \varepsilon\}] \mid [\text{EVT} \perp e \subset \tau_0 \tau \varepsilon] ; \tau[p] p = \tau \omega |] \]

(34)  
\[ \text{a. } [s] \text{busy}_{\tau_0}(s, \text{CTR} \varepsilon), \tau \tau \subset \tau_0 \varepsilon, \text{BEG} s \subset \tau_0 \tau \varepsilon ; \tau[p] p = \tau \omega |] \]

\[ \text{b. } [e] \text{return}_{\tau_0}(e, \text{CTR} \varepsilon), \tau \tau \subset \tau_0 \varepsilon, \text{CON} e, e \subset \tau_0 \tau \varepsilon ; \tau[p] p = \tau \omega |] \]
That is, what holds at the topical instant is the state-equivalent of the verbal eventuality (STA, i.e. the state itself in (34a), consequent state in (34b)). In addition, declarative mood requires current verifiability from the perspective of the speech act. To pass this test, the event-equivalent (EVT, i.e. the beginning of the state in (34a), the event itself in (34b)) must have already happened in the speech world (Tτ) prior to this speech act (Tτ).

In (32a, b), the temporal noun can be interpreted as a topic-setting sentence-modifier (e.g. ‘today-7”) or bottom-elaborating eventuality-modifier (e.g. ‘today-γ”). I formalize this idea by means of two special sequencing operators, topic-comment (7”) and bottom-elaboration (7+), defined below. A topic-comment sequence (A7”; B) reduces to (A; B), iff A (topic-update) adds at least one object to the input T-list and the top T-object in the output of A is referred to in B (comment) by Tα1, for same type a, and maintains its Tα1-rank throughout B (i.e. B can add other types of topics, but not any a-topics.) Otherwise, the output of (A7”; B) is the absurd state, ⊘. (We write γ < z for z = (z1, …, zm, y1, …, yn), where γ ∈ Dn, z ∈ Dm+n, and m ≥ 1. ‘X[YZ]’ stands for the result of replacing every Y in X with Z.) A background-elaboration sequence (A7+; B) is defined analogously for ⊘-lists.

today-γ’ | s/s: Λκ(⌜T[t ≤ i, day.of(θtτ ∧ e)]⌟; K) [ ] := (st)st

today-γ” | s/s: Λη(⌜w⌟)ω(⌜w⌟; ) θ tube, day.of(θtτ ∧ e)) η ∈ {e, σ}, [a] := [ ∧ ]

If the temporal noun in (32a, b) is interpreted as ‘today-γ”, we get the default override reading (35a, b). The topical noun updates the topic time (Tτ) to part of the speech day. Since this can properly include an event, the global λt-update includes within this topical period the event-equivalent, i.e. the beginning of the state in (35a) and the event itself in (35b). Both events must be currently verifiable, i.e. must have already happened in the speech world (Tτ) before the speech act (Tτ). This rules out future topic times. If the temporal noun is read as ‘today-γ”, then it elaborates the verbal base, as in (36a, b). In this case, the topic time is still the speech instant, so we get a temporally elaborated variant of the default pattern (34a, b). For non-future location times this variant is coherent. Future location times are still ruled out because future eventualities fail the current verifiability test.

(35) a. a: Τ[t ≤ i, day.of(θtτ ∧ e)]⌜T[t ≤ i, day.of(θtτ ∧ e)]⌟; ([s] busyTτ(s, CTR ∧ e), θtτ BEG s ⊆ T τ, BEG s ⊆ T τ); [p] = [Tτ] α1

b. [e] returnTτ(e, CTR ∧ e); [p] = [Tτ] α1

(36) a. [s] busyTτ(s, CTR ∧ e), θtτ s ⊆ day.of(θtτ ∧ e), T τ ⊆ T τ, BEG s ⊆ T τ; [p] = [Tτ] α1

b. [e] returnTτ(e, CTR ∧ e), θtτ e ⊆ day.of(θtτ ∧ e), T τ ⊆ T τ, BEG e ⊆ T τ; [p] = [Tτ] α1
For the two-sentence discourse (29i, ii), temporal reference is explicated in (37i, ii). The declarative verbs in (37i, ii) instantiate the default pattern (31a, b) for events (‘enter-’) and states (‘-not’). In (37ii) the dependent factual mood locates the matrix event (beginning of Ole’s unhappy state) within the consequent state of the subordinate event (beginning of his wife’s illness) throughout the matrix common ground (⌜a⌟). This suggests, but does not entail, that the subordinate fact may have caused the matrix fact.

(37i) (29i) Ole-\(^T\) has dropped in.
Ole-\(^T\) enter-Dec,3s

\[ \gamma[x; x = i, ole] \] : ((\(\varepsilon\) enter\(_{\tau_0}\)(\(\varepsilon\), \(\tau\) \(\subseteq\) \(\varepsilon\), \(\varepsilon\) \(\subseteq\) \(\varepsilon\), \(e <_{\tau_0} \tau\) \(\varepsilon\)); \(\gamma[p = \top \alpha]\))

(37ii) (29ii) He\(_r\)’s not happy because his\(_r\) wife is ill.

happy-not-Dec,3s wife-3s, ill-FCT,3s

\[ [s w] happy_w(s, \tau, \delta), \tau \tau \subseteq \varepsilon, \delta_\varepsilon s; [\top \alpha \notin \bot \alpha]; [s] CTR s \gamma T, \tau \tau \subseteq \varepsilon, \delta_\varepsilon s, \\\nBEG s \gamma T, \tau \varepsilon; [\top p = \top \alpha]; [t] \gamma I, \delta_\varepsilon \varepsilon, \delta_\varepsilon s, \\\n[s] ill_\varepsilon(s, \tau, \delta), \tau \tau \subseteq \varepsilon, \delta_\varepsilon s; [\top \alpha; \leq \bot \alpha])\]

To summarize the analysis so far: fact-oriented moods assert that the verbal event-equivalent (EVT) is a currently verifiable fact. Modally, the declarative mood (DEC) locates the matrix event throughout the output common ground (main fact), whereas the factual mood (FCT) locates the subordinate event throughout a superset of this modality (background fact). Both events are thus realized in every live candidate for the speech world and so are verifiable in that world. Temporally, the declarative mood locates the matrix event before the speech act. So, from the perspective of the speech act the matrix event is a currently verifiable fact. The factual mood locates the matrix event within the consequent state of the subordinate event. The subordinate event is thus verifiable from the matrix event and hence from the speech act. The location within the consequent state further suggests that the (real) matrix event may have been caused by the (real) subordinate event. Whether or not there is such a causal link, neither event can be located in the future of the speech act.

We now turn to a special case of fact-oriented discourse—to wit, discourses that introduce currently verifiable attitudinal states.

4 Attitude reports

4.1 Observations

In English, indirect report verbs with non-finite complements are temporarily de se in the sense of Lewis (1979). That is, the complement situation is located in time relative to the attitude-holder’s now. In Kalaallisut, closest equivalents are derivational attitude (att) suffixes. Temporal anaphora shows that att-suffixes introduce attitude states (38a, c) or speech events (38b, d). The attitude or speech can be fact-oriented (38a, b) or prospect-oriented (38c, d). For fact-oriented att-suffixes, the att-event functions as the perspective point for

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locating the base-eventuality, just like the speech event does when the same verbal base is inflected for fact-oriented mood. In either case, future location times are ruled out, as fact-oriented att suffixes in (38a, b) and fact-oriented moods (e.g. DEC and FCT in (25)–(26)) attest. In contrast, prospect-oriented att suffixes (38c, d) and prospect-oriented moods (e.g. OPT and IMP) allow future location times.

(38) Att suffixes (sample)
   a. **Ermini** (*aqagu*) ajugaasoraa.
      irni-ni (*aqagu) ajugaas-suri-pa-a
      son-3Sr (*tomorrow*) win-bel1-Decr1-3s.3s
      He, believes his son to have won (*tomorrow).
   b. **Ermini** (*aqagu) ajugaanerarpaa.
      irni-ni (*aqagu) ajugaan-nirar-pa-a
      son-3Sr (*tomorrow*) win-say1-Decr1-3s.3s
      He, has said his son has won (*tomorrow).
   c. *(Aqagu) iser{-niar -ssa -qina}-poq.
      (aqagu) isir{-niar -ssa -qina}-pu-q
      (tomorrow) enter{-intp} -exp -dread| -DECr3S
      He, intends | is expected | is liable to drop in (tomorrow).
   d. **Ikinnuuni** (aqagu) isequua.
      ikinnuut-ni (aqagu) isir-qqu-pa-a.
      friend-3Sr (tomorrow) enter-bid1-Decr1-3s.3s
      He, has invited his friend to drop in (tomorrow).

Kalaallisut also has attitudinal roots. Lexically, these are unspecified as either fact- or prospect-oriented. However, they can be syntactically specified by a compatible att suffix in the topic-eliciting mood, as (39) illustrates.

(39) Attitudinal roots elaborated by att suffixes
   a. Ole neriuoppq ajugaassaluni.
      Ole niriuq-pu-q ajugaas-s-sa-lu-ni.
      Ole hope-DECr3S win-des1-ELAcr3s
      Ole hopes to win.
   b. Ole ikinnuuni oqarfigaa isequllugu.
      Ole-p ikinnuut-ni uqar-vvig-pa-a isir-qqu-lu-gu.
      Ole-ERG friend-3Sr say-to-DECr1-3s.3s enter-bid1,2-ELAcr3s
      Ole7 has invited his7 friend to drop in.
   c. Ole isumaqarpq ernini ajugaasoralugu.
      Ole isuma-qar-pu-q irni-ni ajugaas-suri-lu-gu.
      Ole idea-have-DECr3S son-3Sr win-bel1,2-ELAcr3s
      Ole7 believes his7 son to have won.
   d. Ole oqarfigaanga ernini ajugaanerarlugu.
      Ole-p oqar-vvig-pa-a nga irni-ni ajugaan-nirar-lu-gu.
      Ole-ERG say-to-DECr73S-3s.1s son-3Sr win-say1,2-ELAcr3s
      Ole7 has told me that his7 son has won.

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We thus arrive at the following observation (see also Bittner 2005):

OBSERVATION 2. Derivational att-suffixes introduce:

i. fact-oriented attitudinal states (e.g. -suri ‘believe’, -paluk ‘seem’)
ii. fact-oriented speech events (e.g. -mirar ‘say’)
iii. prospect-oriented attitudinal states (e.g. -ssa ‘exp [des]’, -niar ‘int [int]’)
iv. prospect-oriented speech events (e.g. -qu ‘bid’)

In Section 2.1, we saw some cross-linguistic evidence that conditionals are modal topic-comment structures (see also Haiman 1978). In Kalaallisut, they are also a species of prospect-oriented attitude reports (recall (1)–(3)). Combining these two ideas, I propose that the antecedent introduces a topical modality, while the matrix comment expresses an attitude to this modality, \( \tau \Omega \). More precisely, an att-suffix introduces a prospect-oriented attitude state whose modal base is \( \tau \Omega \). In the \( \tau \Omega \)-worlds that best fit the projections of the attitude holder, looking from a salient event \( e \), the att-base event is realized within the consequent state of \( e \) and is a verifiable fact by the end of this attitude state. In contrast, fact-oriented att-suffixes are temporally and modally de se. The att-base event is realized before the attitude state and in the same modality. That is, according to the attitude holder, looking from the beginning of the attitudinal state, the att-base event is a currently verifiable fact.

4.2 Attitudes to own vs. topical modalities

Modally, fact- and prospect-oriented att-reports differ as follows. In fact-oriented att-reports the propositional object of the attitude is realized in the ideal worlds of the attitude holder’s own modality. In contrast, in prospect-oriented att-reports the propositional object is realized in the ideal worlds of the topical modality.

To explicate this idea I propose to modify the standard modal theory of attitudes (Hintikka 1969). On this theory, \( x \) believes \( p \) is true in a world \( w \) iff every world where all of \( x \)’s \( w \)-beliefs are true is a \( p \)-world. This wrongly predicts that \( x \) believes every proposition if \( x \) has conflicting beliefs in \( w \) (e.g. that all men are created equal and that a man has a right to own slaves). This type of problem is well known from conditionals and so is the solution—to wit, to quantify only over the best-fitting worlds (Lewis 1973, 1981, Kratzer 1981). Given a set of propositions \( Q \), \( w \) is \( Q \)-better than \( v \), written \( v \prec Q w \), iff every \( Q \)-proposition that holds in \( v \) also holds in \( w \) but not vice versa. The ideal of an ordered set \( \langle p, \prec Q \rangle \), written \( \text{MAX}(p, Q) \), is the set of \( p \)-worlds that are not outranked by any \( Q \)-better \( p \)-world. In particular, worlds can be ranked by attitudes. Table 3 implements this idea in \( \text{UC}_{\omega} \) and UC.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Attitudinal p-sets, induced orders and ideals (( att \in { \text{bel}, \text{exp}, \text{des}, \ldots } ) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.</td>
<td>\text{Attitudinal p-sets, induced orders and ideals (( att \in { \text{bel}, \text{exp}, \text{des}, \ldots } ) ) }</td>
</tr>
</tbody>
</table>
|         | \begin{align*}
| att_{w} x & \text{for } \lambda p. \ att(w, x, p) & \text{UC}_{\omega} \hfill \\
| att_{w} s & \text{for } \lambda p. \ att(w, s, CTR x, p) & \text{UC} \\
| att_{w} e & \text{for } \lambda p. \ \exists s(\text{att}(w, s, CTR e, p) \land \theta_{w} e \in \theta_{w} s) & \text{UC} \\
| (Q: v \prec w) & \text{for } \lambda p(p \in Q \land v \in p) \subset \lambda p(p \in Q \land w \in p) & \text{UC}_{\omega} \\
| \text{MAX}(p, Q) & \text{for } \lambda w. \ w \in p \land \neg \exists w (w \in p \land (Q: w \prec w)) & \text{UC}_{\omega} \\
| \end{align*} |

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ii. Related drt-abbreviations ($a \in \text{DR}(\Theta)$)

\[
\begin{align*}
B[|] & \quad \text{for } \lambda I, \lambda j, B [|] \\
B[ C_{1}, \ldots, C_{n}] & \quad \text{for } \lambda I, \lambda j, B [\lambda i \in C_{i} \wedge C_{i} \subseteq C_{j}] \\
[A_{a} \in B_{(a)max}] & \quad \text{for } \lambda I, \lambda j, [\lambda j, I \wedge A_{j} \subseteq B I] \\
[A_{a} \subseteq B_{(a)max}] & \quad \text{for } \lambda I, \lambda j, I \wedge A_{j} \subseteq B I \\
(\text{att}_W A; W_{1} < W_{2}) & \quad \text{for } \lambda I, \text{att}_W A; W_{1} < W_{2} \\
\text{MAX}(B, \text{att}_W A) & \quad \text{for } \lambda I, \lambda j, \text{MAX}(B^{j}, \text{att}_W A^{j}) \\
\text{MAX}(B |, \text{att}_W A) & \quad \text{for } \lambda I, \lambda j, \text{MAX}(B^{j}, \text{att}_W A^{j}) \\
\end{align*}
\]

Sample entries for a fact-oriented \textit{att}-suffix \textit{-suri} ‘bel,”, prospect-oriented \textit{att}-suffix \textit{-sasa} ‘exp|des”, and attitudinal root \textit{niriuk} ‘hope’, are given below. According to the attitude holder of ‘-bel,”, the \textit{att}-base is a verifiable fact in those worlds of his own modality (\textit{w}) that best fit his (\textit{w})-beliefs. This explicates modal \textit{de se}. The unspecified attitude-holder (unspecified individual \textit{δ}) of the prospect-oriented ‘-exp” projects that the \textit{att}-base will become a verifiable fact in those worlds of the topical modality (\textit{TΩ}) that best fit his (\textit{w})-expectations. Finally, the root ‘hope-’ has a lexically unspecified modal base (\textit{?Ω}).

\[-\text{bel}_1 \rightarrow \text{-(s|p)n) \: \text{s|p) \: \lambda I \lambda j, \lambda w < W \: \lambda \omega \text{; MAX} [w], \text{bel}_1 \lambda x \subseteq \lambda \omega \text{; s|p)\}}
\]

\[-\text{exp} \rightarrow \text{-(s|p)n) \: \text{s|p) \: \lambda I \lambda j, \lambda w < W \: \lambda \omega \text{; MAX} [\lambda \omega \text{; exp} \delta], \text{bel}_1 \lambda x \subseteq \lambda \omega \text{; s|p)\}}
\]

\[-\text{hope-} \rightarrow \text{-(s|p)n) \: \text{s|p) \: \lambda I \lambda j, \lambda w < W \: \lambda \omega \text{; MAX} [\lambda \omega \text{; hope} \delta], \text{bel}_1 \lambda x \subseteq \lambda \omega \text{; s|p)\}}
\]

For example, the fact-oriented \textit{att}-report (40) is assigned the representation (41). In the topical speech world (\textit{Tω}), Ole has a belief about his own modality (\textit{Tω}). In the top-ranked worlds of this modality, his son’s victory is a verifiable fact.

\begin{align*}
(40) & \quad \text{Ole-p irni-ni (*aqaga) ajugaa-suri-pa-a.} \\
& \quad \text{Ole-ERG son-3S \_ (*tomorrow) win-bel_;-DEC_;-3S \_3S} \\
& \quad \text{Ole believes his son to have won (*tomorrow).}
\end{align*}

\begin{align*}
(41) & \quad [x = \text{ole}] \Rightarrow [x \text{ son in } \lambda I \text{; win}_a \text{; \lambda \omega}] \Rightarrow \text{bel}_1 \text{; win}_a \text{; } \lambda \omega \text{; \lambda \omega}_1 \subseteq \lambda \omega \text{; s|p)\}}
\end{align*}

In discourse (42), sentence (i) reports Ole’s desire and hope, while (ii) makes a related prediction. Modal reference is explicated in (43i, ii). In the input to (43i) the topical modality (\textit{TΩ}) is the initial common ground. This is the modal base of Ole’s desire-and-hope. Within this topical modality, the topical Ole wins in every world that best fits what he desires and hopes in the topical speech world (\textit{Tω}). The topical modality is updated to the set of surviving speech worlds, where Ole is in this attitudinal state. (43ii) represents the reading of (42ii) where the unspecified attitude-holder (\textit{?δ}) is resolved to the speaker (i) and the expectation is contingent on Ole’s victory (anaphora to the winning worlds by \textit{\lambda \omega}). In the topical speech world (\textit{Tω}) the speaker has a certain expectation about the current topical modality (\textit{TΩ}), i.e. the updated common ground where Ole is in the aforementioned state of desire and hope. In the worlds of this topical modality that best fit the speaker’s (\textit{Tω})-expectations, Ole does win (anaphora by \textit{\lambda \omega}) and his (\textit{Tω})-wife is happy.
(42) i. **Ole niriuk-pu-ʔ (aqagu) ajugaa-ssa-llu-ni.**  
Ole hope-DEC-3S (tomorrow) win-des-ELA-3S-
Ole hopes to win (tomorrow).

ii. **Nulti-a muannaar-ssa-pu-ʔ.**  
wife-3S-
His wife will be happy.

(43) i. $\Gamma[x = \text{ole}]; [w] \text{win}_\text{e}(\top, \ominus); [\text{MAX} \{\top, \text{des}_\text{e} \text{win}_\text{e} \ominus\}] \subseteq \ominus \omega[\Omega]; [\text{MAX} \{\top, \text{hope}_\text{e} \text{win}_\text{e} \ominus\}] \subseteq \ominus \omega[\Omega]; [\gamma] p = \top \omega[\Omega]]$

ii. $[x = \top \ominus]; [x] \text{wife}_\text{e}(x, \ominus \ominus); [\text{happy}_\text{e} \ominus(\top \ominus)]; [\text{MAX} \{\top, \text{exp}_\text{e} \ominus\}] \subseteq \ominus \omega[\Omega]; [\gamma] p = \top \omega[\Omega]]$

In summary, fact-oriented *att*-suffixes are modally *de*, prospect-oriented *att*-suffixes are *de* $\top \Omega$, whereas attitudinal roots are modally unspecified.

### 4.3 Subjective facts vs. projected consequences

Attitudinal states have a beginning and an end, like all human states. Throughout life we form and abandon beliefs, expectations, desires, regrets, anxieties, and so on. At any point we may wish to talk about past, present, or future attitudinal states. In the temporally explicit language of UC an attitudinal *p*-set is therefore based not on an individual, but on an attitudinal state or on a concurrent event centered on the attitude holder (recall Table 3.i).

Enriched with temporal referents, the proposed lexical entries for report items are given below. According to the ego *(CTR $\perp \sigma$)* of a fact-oriented belief state, ‘-bel $\perp$’, the event of the base *(EVT $\perp \eta$)*, with $\eta \in \{e, \sigma\}$, is a currently verifiable fact. That is, it is realized in the same world as, and prior to, this attitudinal state. In contrast, the ego of a prospect-oriented state of expectation, ‘-exp $\perp$’, views the event of the base *(EVT $\perp \eta$)* as a projected consequence of a contextually salient event (?e). In the ideal worlds of the topological domain $(\top \Omega)$ the projected consequence is a verifiable fact by the end of this attitudinal state.

```
-bel $\perp$ | (s|pn)s: $\lambda p \lambda x \lambda w (\Gamma \perp \omega \perp t; [\emptyset \emptyset] \emptyset \sigma \omega \sigma \sigma \sigma);$
[s] $\exists t, \sigma \omega \perp t, \sigma \sigma \sigma \sigma$  
[\gamma] $\text{bel}_x \perp \sigma \sigma \sigma \sigma$

-exp $\perp$ | (s|pn)s: $\lambda p \lambda x \lambda w (\Gamma \perp \omega \perp t; [\emptyset \emptyset] \emptyset \sigma \omega \sigma \sigma \sigma);$
[s] $\exists t, \sigma \omega \perp t, \sigma \sigma \sigma \sigma$  
[\gamma] $\text{exp}_x \perp \sigma \sigma \sigma \sigma$

hope- | (s|pn)s: $\lambda p \lambda x \lambda w (\Gamma \perp \sigma \perp t; [\emptyset \emptyset] \emptyset \sigma \omega \sigma \sigma \sigma);$
[s] $\exists t, \sigma \omega \perp t, \sigma \sigma \sigma \sigma$  
[\gamma] $\text{hope}_x \perp \sigma \sigma \sigma \sigma$
```

This correctly predicts that only prospect-oriented *att*-suffixes allow future location times. For discourse (42i, ii) temporal reference is explicated in (44i, ii). In (44ii) topic-elaborating mood on a state of desire identifies it with the topical Ole’s state of hope, by equating both with the same topical state. The resulting representation is coherent because ‘tomorrow-’ locates the desired victory, whereas the attitudinal state of desire is verifiable now. In (44ii) the wife’s happy state is an expected consequence of Ole’s victory.
(44i) (42i) Ole hopes to win tomorrow.
Ole: hope-DEC+3s \( \tau \) tomorrow-\( \tau \) win-des^{-}-ELA+3s \( \tau \)
\( \tau [x \models i \omega \text{ole}]; \{ \tau [x], [x w] \text{win}_{\omega}(e, \text{CTR } \top \sigma], \text{CTR } e \subseteq i \text{day:after}(\partial_{\tau_{\omega}} \top \sigma), e \subseteq \rho \text{CON } \top \sigma] ; [s] \models \text{END } s; \text{MAX}(\top \Omega, \text{des}_{\tau_{\omega}} \bot \sigma) \subseteq \bot \sigma \mid \text{\{}[\top \sigma \models i \bot \sigma]\}; \{[s] \text{CTR } s=i \text{ \top } \sigma]; \text{MAX}(\top \Omega, \text{hope}_{\tau_{\omega}} \bot \sigma) \subseteq \bot \sigma \mid \text{\{}[\top \sigma \models i \bot \sigma]\}); [\top \tau \text{ } \subseteq i \partial_{\tau_{\omega}} \bot \sigma, \text{BEG } \bot \sigma \text{ } <_{\tau_{\omega}} \top \sigma]; \{[p] \models p = \top \sigma]\]

(44ii) (42ii) His wife will be happy.
wife-3s \( \bot \) happy-exp^{-}-DEC+3s
\( [x] \models i \partial_{\delta}]; [x \text{ wife}_{\tau_{\omega}}(x, \bot \delta, \top \tau)]; [s] \text{ happy}_{\bot \omega}(s, \top \delta), \text{BEG } s \subseteq \bot \omega \text{ CON } \bot \sigma]; [x] \text{BEG } \bot \sigma <_{\bot \omega} \text{ END } s]; \text{MAX}(\top \Omega, \text{expr}_{\tau_{\omega}} \bot \sigma) \subseteq \bot \sigma \mid \text{\{}[\top \sigma \models i \bot \sigma]\}); [\top \tau \text{ } \subseteq i \partial_{\tau_{\omega}} \bot \sigma, \text{BEG } \bot \sigma \text{ } <_{\tau_{\omega}} \top \sigma]; \{[p] \models p = \top \sigma]\]

In contrast, a future location time cannot be coherently added to the temporally explicit representation (45) of the fact-oriented belief report (40). The declarative mood asserts that Ole is in a currently verifiable state of belief. The beginning of this attitudinal state must therefore precede the speech act. But this state-onset also serves as the perspective point for Ole, the attitude holder, and according to him, his son’s victory is verifiable from that point. Therefore, the son’s victory cannot be located in the future of the speech act either.

(45) (40) Ole believes his son to have won (*tomorrow).
Ole: erg son-3s \( \ast \) (tomorrow-\( \ast \)) \text{ win-bel}_{-}\text{-DEC}^{+}3s \( \ast \)
\( \tau [x \models i \omega \text{ole}]; [x] \text{ son}_{\tau_{\omega}}(x, \text{ } \top \delta, \top \tau)]; [t e w] \text{ win}_{\omega}(e, \bot \delta], \text{CTR } e <_{i t}, t \subseteq i \text{ \partial } \omega \text{ CON } e]; [s] \text{ \partial } \tau_{\omega} s = i \text{ } \partial \tau, \text{CTR } s=i \partial \tau]; \text{MAX}(\top \omega, \text{bel}_{\tau_{\omega}} \bot \sigma) \subseteq \bot \sigma \mid \text{\{}[\top \sigma \models i \bot \sigma]\}); [\top \tau \subseteq i \partial_{\tau_{\omega}} \bot \sigma, \text{BEG } \bot \sigma \text{ } <_{\tau_{\omega}} \top \sigma]; \{[p] \models p = \top \sigma]\]

In summary, att-suffixes in fact-oriented moods introduce currently verifiable attitudinal states (or speech events). If the att-suffix is likewise fact-oriented, then the attitude-holder views the att-base event as a currently verifiable fact of his own modality. If the att-suffix is prospect-oriented, then he views it as a projected consequence of a contextually salient event. In his ideal worlds of the topical modality the projected event becomes a verifiable fact by the end of the prospect-oriented attitudinal state.

5 Conditional attitudes

5.1 Observations

Cross-linguistically, conditionals behave like modal topic-comment structures (recall Section 2.1). The antecedent introduces a topical sub-domain of the modal base (Kratzer 1981), while the matrix comments on this topical sub-domain (\( \top \Omega \)). In Kalaallisut the an-
operator (pend) propose that c throughout the comment input pic attitudinal correlate in the matrix, on pain of ungrammaticality (*).

The correlate can be a prospect-oriented att-suffix (e.g. (46a, b), (47a, b)), prospect-oriented illocutionary mood (e.g. OPT in (46c)), or an implicitly attitudinal root that can be read as prospect-oriented (e.g. (47c)).

(46) Ole ajugaa-gu-ni …
Ole win-HYP$_p$-3S$_v$ …
If (or when) Ole$^*$ wins …
a. … isir-{s-ssa | -qina | -sinnaa}-pu-q.
   … enter-{exp | -dread | -possible} -DEC$_r$-3S
   … he$_r$ is {expected to} {liable to} {might} drop in.
b. … isir-{s-sanga | -niar | -rusuk} -pu-q.
   … enter-{exp$_n$ | -int$_n$ | -des$_n$} -DEC$_r$-3S
   … he$_r$ {expects} {intends} {wants} to drop in.
c. … isir-li! *isir-pu-q.
   … enter-OPT.3S *enter-DEC$_r$-3S
   … let him$_r$ drop in! *he$_r$ has dropped in.

(47) Ole ajugaa-pp-at …
Ole win-HYP$_p$-3S$_v$ …
If (or when) Ole$^*$ wins …
a. … Aani-p isir-{s-sangatit | *suri}-pa-a.
   … Am-ERG enter-{exp$_l$ | *bel$_l$} -DEC$_r$-3S.3S
   … Am {expects him$_l$ to drop in} {believes him$_l$ to have dropped in}.
b. … Aani-p isir-{q-qu | *-niar}-pa-a.
   … Am-ERG enter-{bid$_r$ | *say$_r$} -DEC$_r$-3S.3S
   … Ann has {told him$_l$ to drop in} {said he$_r$ has dropped in}.
c. … ajunngit-la-q | *nuannaar-pu-nga.
   … fine-DEC-3S *happy-DEC$_r$-1S
   … that’s fine (by me). {NOT: I am happy.}

Observation 3. A dependent in the hypothetical mood (HYP) requires a prospect-oriented attitudinal correlate in the matrix, on pain of ungrammaticality.

I propose to derive this observation from topic-comment sequencing. Recall that a topic-comment sequence ($A \vdash B$) reduces to plain ($A; B$), iff the topic update $A$ extends the input $\top$-list with at least one object, and the top object in the output of $A$ is referred to in the comment $B$ by an anaphor $\top a$, for some type $a$, and maintains its $\top a$-prominence rank throughout $B$. Otherwise, the input state of information is reduced to the absurd state ($\top$). I propose that conditionals are topic-comment sequences with $a = \Omega$. In Kalaallisut, the dependent in the hypothetical mood introduces an $\Omega$-topic and the topic-comment sequencing operator ($\ldots \vdash \ldots$), whereas the $\top \Omega$-anaphor comes from the attitudinal correlate.
5.2 Conditional = modal topic + attitudinal comment

In Kalaallisut the dependent hypothetical mood (HYP) forms a modal topic-comment sequence with the verbal base of the modified verb (see Section 7 for compositional details). The modal topic is the set of worlds, within a salient modal base (ωα), where the antecedent hypothesis is realized. The modified verbal base must comment on this topical subdomain, lest the output of the topic-comment sequence (A ⊤; B) be the absurd state (⊥). That is why the modified verbal base must contain a ⊤Ω-anaphor.

\[-\text{HYP} \vdash (s/\gamma)\text{pniv: } \lambda P_2 \lambda x \lambda w \lambda \omega \{ P \times \lambda \omega \{ [\bot \omega \in \omega \alpha] ; \{ [p | p = \bot \omega] \} \} ; \{ [p | p = \omega \alpha] \} \} ; \{ [p | p = \bot \omega] \} \} \]  

For example, in discourse (48) a report of a conditional promise by Ole (48i) is followed by a conditional prediction (48ii), contingent both on its own antecedent and on Ole making good on his promise. Modal reference is explicated in (49i, ii). In (49i) the antecedent clause introduces a topical hypothesis: the set of worlds, within the common ground (ωα), where Ole wins. In the consequent, this topical sub-domain (⊤Ω) is the modal base of an attitudinal comment. This introduces Ole’s promise as a (⊤ω)-real speech event resulting in a (⊤ω)-real state of obligation and expectation. In the antecedent (⊤Ω)-worlds that best fit Ole’s (⊤ω)-obligations and expectations he drops in. Note that Ole need not expect and has not promised to win. His promise and expectation are contingent on his victory, which may be a long shot. The intuition that (48ii) is contingent not only on its own antecedent but also on (48i) is explicating in (49ii) as modal anaphora (‘modal subordination’ à la Stone 1997, Brasoveanu 2007). The declarative matrix introduces a (⊤ω)-real state of expectation of the speaker. The modal base (⊤Ω) of this attitudinal state is the current antecedent hypothesis, i.e. the sub-class of the promised dropping-in worlds (modal anaphora by ⊥ω) where the speaker’s wife buys some wine. In the modal-base (⊤Ω)-worlds that best fit the speaker’s (⊤ω)-expectations the topical Ole (⊤δ) is happy.

(48) i. Ole ajuga-gu-ni niriursi-pu-q isir-ssa-lua-ni.  
Ole win-HYP,3Sr promise-DEC,3S enter-exp-ELA,3Sr  
If Ole wins, he has promised to drop in.

wife-1S wine-get-HYP,3S happy-exp-DEC,3S  
If my wife gets some wine, he’ll be happy.

(49) i. (([x] x = ole); [w] win, (⊤δ)); [⊥ ω ∈ (⊤ω)]; \{ [p | p = ⊥ ω] \} ; \{ [enter,ω (⊤δ)]; [MAX(⊤Ω, exp, ⊤δ) ⊥ ω ∈ (⊤ω)]; [spk,ω (⊤δ)]; [MAX(⊤Ω, obt, ⊤δ) ⊥ ω ∈ (⊤ω)]; \{ [p | p = ⊤ ω] \} ; \{ [p | p = ⊥ ω] \} \} ; \{ [p | p = ⊥ ω] \} \}   \{ [p | p = ⊥ ω] \} \} ; \{ [p | p = ⊥ ω] \} \} ; \{ [p | p = ⊥ ω] \} \} \}

Conditional expectations may also concern consequences of past events, as in the grammatical version of discourse (50i, ii), which is analyzed in (51i, ii).
(50) i. Kennedy tuqu-taa-pu-q.
Kennedy kill-pssv-DEC_{\tau}-3S
Kennedy was assassinated.
ii. Oswald-p tuqu-sima-nggi-p-p-a-gu
Oswald-ERG kill-prf-not-HYP_{\tau} -3S_{\tau} -3S_{\tau} -3S_{\tau} 
imuk-piluk-qat-a-ata tuqu-sima-*(t-ssa)-pa-a.
man-bad-other-3S_{\tau} -3S_{\tau} kill-prf*(exp)-DEC_{\tau} -3S_{\tau} -3S_{\tau}
If Oswald didn’t kill him, then someone else did.

(51) i. \( \{[x \ x \ = \ j \ f \ k]; [x \ kill_{\tau\omega}(x, \ \tau \ \delta)]; \; \gamma\{p \ p = \ \tau \ \omega]\} \)
ii. \( \{([w \ x \ = \ i \ osw, \ kill_{\tau\omega}(x, \ \tau \ \delta)]; [w \ w \ \in \ \perp \ \omega]]; \; \gamma\{p \ p = \ \perp \ \omega]\} \tau\); \n\( \{[x \ x \ = \ \delta \ \delta]; [x \ man_{\tau\omega}(x)]; \; [\ \delta \ \delta \ \in \ \perp \ \omega]]]; \; \gamma\{p \ p = \ \perp \ \omega]\} \tau\); \n\( [kill_{\tau\omega}(\tau \ \delta, \ \perp \ \delta)]; \; \gamma\{p \ p = \ \tau \ \omega]\} \tau\)

In the output of (51i) JFK is assassinated throughout the common ground (output \( \tau \ \omega \)).
The conditional (51ii) introduces a \( \tau \ \omega \)-real state of expectation based on this \( \tau \ \omega \)-real assassination event. The modal base \( \tau \ \omega \) is the topological sub-domain, of the common ground \( \tau \ \omega \), where the assassin is not Oswald. In the modal base worlds that best fit the attitude holder’s projections the assassin is someone else.

If the \( \tau \ \Omega \)-anaphor \( \text{ssa} \) ‘exp’ is omitted from the consequent, the conditional (50ii) becomes ungrammatical and uninterpretable (see (52)). For without a \( \tau \ \Omega \)-anaphor there is no proper comment, so the modal topic-comment sequence formed by the hypothetical mood reduces any input state to the absurd state (\( \emptyset \)).

(52) \( \epsilon([([w \ x \ = \ i \ osw, \ kill_{\tau\omega}(x, \ \tau \ \delta)]; [w \ w \ \in \ \perp \ \omega]]; \; \gamma\{p \ p = \ \perp \ \omega]\} \tau\); \n\( ([x \ x \ = \ i]; [x \ man_{\tau\omega}(x)]; [\ \delta \ \delta \ \in \ \perp \ \omega]]]; \; \gamma\{p \ p = \ \perp \ \omega]\} \tau\); \n\( [kill_{\tau\omega}(\tau \ \delta, \ \perp \ \delta)]; \; \gamma\{p \ p = \ \tau \ \omega]\} \tau\)

5.3 Projected consequences in topological sub-domains

To factor in temporal reference we first spell it out in the entries of two key moods: hypothetical (HYP) and topic-elaborating (EL\( \lambda \_\alpha \_\tau \_\)):

- HYP \( \vdash \ (s/g) \ pn/i\!v: \lambda P \lambda \lambda \lambda \lambda A \lambda \lambda \lambda \lambda w. \ ((P \ x \ \perp \ \omega \cdot; [?e < \perp \ \omega \ \text{EVT} \ \perp \ \eta]); [\ \perp \ \omega \ \in \ \perp \ \omega]\); \n\( \gamma\{p \ p = \ \perp \ \omega]\} \tau\); \n\( [P \ x \ \perp \ \omega \cdot; [\ \perp \ \omega \ \in \ \perp \ \omega]\] \)

- EL\( \lambda \_\alpha \_\tau \_\) \( \vdash \ (s/g) \ pn/i\!v: \lambda P \lambda \lambda \lambda \lambda A \lambda \lambda \lambda \lambda w. \ (\gamma\{s\} \tau); (P \ x \ \perp \ \omega \cdot; [\ \tau \ \sigma = \ \perp \ \eta]); \n\( \gamma\{p \ p = \ \perp \ \omega]\} \tau\); \n\( [\ \tau \ \sigma = \ \perp \ \eta] \)

Hypothetical mood is prospect-oriented. It introduces a topological sub-domain of a contextually salient set of worlds \( \gamma\{\omega\} \), where the event-equivalent of the verbal base \( \text{EVT} \ \perp \ \eta \) is realized after a salient perspective point \( ?e \). In contrast, topic-elaborating mood is not only modally but also temporally \textit{de se}: it identifies the dependent state-equivalent \( \text{STA} \ \perp \ \eta \) with the matrix state-equivalent \( \text{STA} \ \perp \ \eta' \) by equating both with its own topical state.

[ Linguistische Arbeiten: Musterseiten Sammelband]
Both moods are exemplified in discourse (48i, ii). Temporal reference in this discourse is analyzed in (53i, ii) (building on the analysis of modal reference in (49i, ii)). In (53i) the hypothetical antecedent introduces a topical sub-domain of the common ground (input \(\tau a\)) where Ole wins after this speech act (\(\tau e\)). The matrix is required to comment (''). The comment is an attitude report: in the speech world (\(\tau o\)), Ole has made a promise resulting in a (\(\tau e\)) current state of obligation-and-expectation in regard to the antecedent agent (\(\tau o\)). In the antecedent winning worlds that best fit this \(\tau e\)-current promise Ole drops in within the consequent state of his victory (\(CON \bot e\), verification frame for the promise). The subordinated conditional prediction (48ii) introduces a \(\tau e\)-current state of the attitude holder’s expectations in regard to the antecedent agent (\(\tau o\)). The comment is an attitude report: in the speech world (\(\tau o\)), Ole has made a promise resulting in a \(\tau e\)-current state of obligation-and-expectation in regard to the antecedent sub-domain (\(\tau \Omega\)). In the antecedent winning worlds that best fit his \(\tau e\)-current promise Ole drops in within the consequent state of his victory (\(CON \bot e\), verification frame for the promise). The subordinated conditional prediction (48ii) introduces a \(\tau e\)-current state of the modal base (current \(\tau \Omega\)) is the topical sub-domain, of the promised dropping-in worlds (modal anaphora by \(\bot o\)), where the antecedent prospect is realized, i.e. where the speaker’s wife babys some wine after this speech act (\(\tau e\)). In the modal base worlds that best fit the \(\tau e\)-current \(\tau o\)-expectations of the attitude holder (speaker?) there is a happy state of the topical Ole (\(\tau o\)) that begins within the consequent state of the wine-buying event (current \(CON \bot e\), verification frame for this prediction).

(53i) (48i) If Ole has promised to drop in.
Ole \(\text{win-HYP}_{\tau -3S}\) …
\(\{([x] x = o l e; [e wi] \text{win}_{\omega}(e, \tau \delta); \tau e < \omega e; [\bot \omega \in \tau a]%; [\epsilon p = \bot o]\} \tau ; \ldots \text{promise-DE} \tau_{\tau -3S} \text{enter-exp-} \text{ELA}_{\tau -3S} \tau_{\tau -3S} \ldots\)
… \(\{([x] e \text{enter}_{\bot \omega}(e, \text{CTR } \tau \sigma), e \subset \omega \text{ CON } \bot e; [\epsilon \bot e < \omega \text{ END } s]; [\text{MAX}(\tau \Omega, \exp_{\tau \omega} \bot \omega) \subseteq \bot \omega, \tau \omega]; [\tau \sigma \in \bot \omega] \}; \{[e] \text{spk}_{\tau \omega}(e, \tau \delta); [\text{MAX}(\tau \Omega, \text{obl}_{\tau \omega}, \text{CON } \bot e) \subseteq \bot o, \tau e]; [\tau \sigma \in \tau \omega] \}; [\tau \sigma \in \tau \omega] \} \}

(53ii) (48ii) If my wife gets some wine, he’ll be happy.
wife-1S \(\text{wine-get-HYP}_{\tau -3S}\) …
\(\{([x] \text{wife}_{\tau \omega}(x, \text{CTR } \tau e, \tau \sigma); [e] \text{wine}_{\bot \omega}(\text{BCK } e, \text{CTR } \tau e, \bot \omega e), \text{get}_{\bot \omega}(e, \bot \delta, \text{BCK } e), \tau e < \omega e; [\bot \omega \in \tau a]; [\epsilon p = \bot o]\} \tau ; \ldots \text{happy-exp-} \text{DE} \tau_{\tau -3S} \text{DE} \tau_{\tau -3S} \ldots\)
… \(\{([s] \text{happy}_{\bot \omega}(s, \tau \delta), \text{BEG } s \subset \omega \text{ CON } \bot e; [s] \text{BEG } \bot \sigma < \omega \text{ END } s]; [\text{MAX}(\tau \Omega, \exp_{\tau \omega} \bot \omega) \subseteq \bot \omega, \tau \sigma]; [\tau \sigma \in \tau \omega] \}; [\tau \sigma \in \tau \omega] \}

For discourse (50i, ii), temporal reference is explicatur in (54ii) (building on (51i, ii)). In the output of (54) there is an assassination event before this speech act (\(\tau e\)) throughout the common ground (\(\tau a\)). This real event is the basis of the real state of expectation introduced in (54ii). The modal base is the topical sub-domain of the common ground (\(\tau a\)), where the assassin is not Oswald. Within this sub-domain, the worlds that best fit the attitude holder’s expectations are those where the real assassination event (\(\bot e\)) is followed by the consequent state of an assassination by an agent other than Oswald.

(54i) (50i) Kennedy was assassinated.
Kennedy-1S \(\text{kill-PSV}_{\tau -3S}\)
\(\tau p = \bot o\)}
(54ii) (50ii) If Oswald didn’t kill him, someone else did.

Given a contextually salient modal base, the antecedent introduces a topical sub-domain where a hypothetical prospect, viewed from a contextually salient perspective point, is realized. The comment introduces a prospect-oriented attitude to a projected consequence—of the antecedent event (as in (53i, ii)) or of the initial perspectival event (as in (54ii))—in this topical sub-domain. This attitudinal state is a currently verifiable fact even if the modal object of the attitude is not. Indeed, the modal object need not even be considered possible, as the next section will show.

6 Attitudes to remote modalities

6.1 Observations

Stone (1997) argues that, in addition to anaphoric tenses (Reichenbach 1947, Partee 1973, Webber 1988, a.o.), English has anaphoric modals. He proposes a parallel theory, where temporal relations between the speech time and the topic time, e.g. past, present, and future, are paralleled by modal relations between the speech modality and the topical modality, e.g. real, vivid (i.e. realistic, desirable, etc), and remote (counterfactual, undesirable, etc). Stone and Hardt (1999) further propose that the English negation not introduces a referent for the scope proposition and asserts that it is disjoint (remote) from the common ground.

In Kalaallisut discourse reference to remote modalities is expressed by derivational suffixes. For example, the negation suffix -ngit ‘not’ asserts that the world of evaluation is remote from the scope proposition (same as English not), and introduces a concurrent non-scope state (Section 3.3). Another ‘negative’ suffix, -galuar ‘rem’, which often elaborates negation, asserts that the world of evaluation is sub-optimal given what the speaker (or topic) believes or wants. Typical uses of this suffix are described and exemplified below (Observation 4 in (55), (58i, ii), Observation 5 in (56)-(59), Observation 6 in (58ii), (59ii)).

Observation 4. If a currently verifiable fact has an unexpected and/or undesirable circumstance, then the fact or the circumstance is marked as remote.
OBSERVATION 5. An attitude or speech whose modal object is unlikely or undesirable (or negated) is marked as remote (or negative).

OBSERVATION 6. A counterfactual, unlikely, or undesirable hypothesis is marked as remote.

(55) **Ole ullumi ajugaagaluurunu isinngilaq.**
**Ole ullumi ajugaag-galuar-lulu-ni isir-nggit-la-q**
Ole today win-rem-ELA₃₇-3Sᵣ enter-not-DEC-1S
Ole won today, but didn’t drop in.

(56) **Ole neriukkaluarpoq ajugaassalluni. Nulia maannaassagaluarpoq.**
**Ole niriuk-galuar-pu-q ajugaas-sa-lulu-ni. nulia-a maannaar-ssa+galuar-pu-q**
Ole hope-rem-DEC₃₇-3S win-des*-ELA₃₇-3Sᵣ wife-3Sₗ happy-exp⁰+rem-DEC₃₇-3Sᵣ
Ole hopes to win (long shot). His wife would be happy.

(57) **Ole aqagu isequunngilara. Taamaattumik isissanngilaq.**
**Ole aqagu isir-qui+nggit-la-ra. taamaattumik isir-ssa+nggit-la-q**
Ole tomorrow enter-bid.⊥+not-DEC-1S₁₃S therefore enter-exp⁺+not-DEC-3Sᵣ
I have told Ole not to drop in tomorrow. So he won’t (isn’t expected to) drop in.

(58) i. **Nuliaqaraluarlunga meeraqangngilanga. nulia-qar-galuar-lulu-ni miiraq-qar-nggit-la-ni-ni.**
    wife-have-rem-ELA₁₃S kid-have-not-DEC-1S
    I have a wife, but no kid(s).

ii. **Erneqaralaruma ajunjinnerutikkaluarpara.**
    tiri-qar-galuar-gu-ma ajunngirt-niru-tit-galuar-pu-ra
    son-have-rem-HYP₁₃S fine-er-tv-rem-DEC₃₇-1S₁₃S
    I wish I had a son. (lit. I prefer the remote hypothetical worlds where…)

iii. **Taava toqguma taassuma nulia ra najusagaluarpa.**
    Taava tuq-gu-ma taassuma nulia-ra najur-ssa+galuar-pu-a.
    then die-HYP₁₃S that.ERG wife-1S be.with-exp⁺+rem-DEC₃₇-1S₁₃S
    Then when I die, he would’ve been there for my wife.

(59) i. **Kennedy toqutaavog akerapassuaqarami.**
    Kennedy tuq-taa-pu-q akirap-pasua-qaar-ga-mi
    Kennedy kill-pssv-DEC₃₇-3Sₗ enemy-many-have-FCT₁₃Sₗ
    Kennedy was assassinated because he had many enemies.

ii. **Oswaldip toqusimangngikkaluarpaqau**
    Oswald-p tuq-tima-nggit-galuar-pu-a-gu
    Oswald-ERG kill-prf-not-rem-HYP₁₃S₁₃S⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻{-}

To account for these observations, I propose to build on the idea that negation involves
discourse reference to a remote modality (Stone and Hardt 1999). For the negation suffix (-morighi) this idea has already been implemented (in Section 3 and (51ii)). In addition, I propose that the remoteness suffix -galuar ‘rem’ is implicitly attitudinal: it asserts that the world of evaluation is remote from (not among) the modal base worlds that are top-ranked by the beliefs, expectations, or desires of a current center of empathy (speaker or topic). Given the proposed analysis of fact-oriented mood, hypothetical mood, and attitude reports, Observations 4–6 are then accounted for, as Sections 6.2 and 6.3 explicate for modal and temporal reference in turn.

6.2 Remoteness from attitudinal ideal

The following lexical entry implements the idea that the remoteness suffix -galuar ‘rem’ implies an attitude to a contextually salient modal base (?ω). It asserts that the world of evaluation (ω) is remote from (∉) the top-ranked modal base worlds. The ranking criteria are the beliefs, expectations, or desires of a current center of empathy in the topical speech world (att?ω, ?δ, with att ∈ {bel, exp, des} and ?δ ∈ {CTR, MAX, T}). The modal base (?ω) includes both the speech world (T ω) and the scope world (⊥ ω). The world of evaluation (ω) is one of these two worlds. If the remoteness suffix is attached to an attitudinal RPT-suffix, then the two form a complex attitude (e.g. -sa+galuar ‘exp+rem’). In effect, their relative scope is reversed (e.g. ‘?exp+rem’ is interpreted as ‘(?exp)-rem’).

\[-rem \vdash \xi: [\omega \in \{?\omega, \text{att?}\delta\}]\]

For example, modal reference in discourse (58i, ii) is analyzed in (60i, ii). (The subordinated counterfactual (58iii) involves temporal anaphora; it is analyzed in Section 6.3.) In (60i) the modal base of ‘-rem’ is the set of worlds where the speaker has a wife (⊥ ω). The world of evaluation (T ω) is in this domain, but not in the speaker’s preferred sub-domain. Neither is it in the sub-domain where the speaker has a kid. This suggests that the speaker would prefer a kid-and-wife world to the actual wife-only world.

(60i) (58i) I have a wife, but no kid(s).

wife-have-rem-ELA,1S kid-have-not-DEC-1S

\n\n{\begin{align*}
\text{[w]: } & \text{wife have}_{\omega_{\omega}}(1); [\perp \omega, T \omega \in \perp \omega]; [T \omega \notin \text{MAX } \{(\perp \omega), \text{att} \omega_{\omega}, \text{dec} \omega_{\omega}\}]; [w \text{ kid have}_{\omega_{\omega}}(1)]; [T \omega \notin \perp \omega]; \frac{p}{p = T \omega}
\end{align*}\n}

(60ii) (58ii) I wish I had a son.

son-have-rem-HYP,1S fine-er-tv-rem-DEC,1S.3S

\n\n{\begin{align*}
\text{condition: } & \text{[son have}_{\omega_{\omega}}(1)]; [\perp \omega, T \omega \in \perp \omega]; [\perp \omega \notin \text{MAX } \{(\perp \omega), \text{bel} \omega_{\omega}, \text{dec} \omega_{\omega}\}]; \frac{p}{p = \perp \omega}; \\
\text{counterfactual: } & \text{[son have}_{\omega_{\omega}}(1)]; [T \omega \notin \perp \omega]; [\perp \omega, T \omega \in \perp \omega]; [T \omega \notin \perp \omega]; \frac{p}{p = \perp \omega}; \\
\text{topical hypothesis: } & \text{[des} \omega_{\omega} < T \omega \in \perp \omega]; [T \omega \notin \perp \omega]; [\perp \omega, T \omega \in \perp \omega]; [T \omega \notin \text{MAX } \{(\perp \omega), \text{dec} \omega_{\omega}, \text{bel} \omega_{\omega}\}]; \frac{p}{p = \perp \omega}; \\
\text{counterfactual: } & \text{[son have}_{\omega_{\omega}}(1)]; [T \omega \notin \perp \omega]; [\perp \omega, T \omega \in \perp \omega]; [T \omega \notin \perp \omega]; \frac{p}{p = \perp \omega}; \\
\end{align*}\n}

The counterfactual (60ii) makes this explicit. The input modal base is the aforementioned domain where the speaker has a wife (current ?ω). The topical hypothesis is the sub-domain where he also has a son. Given the speaker’s beliefs, which presumably include
(60i), this sub-domain is remote from the wife-only sub-domain the speaker believes he inherits. The main attitudinal comment is that in the topical speech world (IRMWARE) the speaker prefers the remote topological sub-domain (IRMWARE), where he also has a son, to the speech reality (IRMWARE), where he only has a wife.

In the counterfactual Kennedy discourse, the opening sentence (59i) introduces a background fact (FT), while the counterfactual (59ii) projects an expected consequence of this fact in a remote modality. Modal reference in this discourse is explicaded in (61i, ii). In (61i), JFK is assassinated throughout the common ground output by the declarative matrix (IRMWARE). The post-posed factual clause adds a background fact—to wit, a larger modal domain where JFK has many enemies (IRMWARE). In the following counterfactual (61ii), hypothetical mood picks up this background fact as the modal base (current \( \perp \omega_0 \)) and introduces as a topical hypothesis the sub-domain where JFK is not assassinated by Oswald. The remoteness suffix adds that this sub-domain is remote from the speaker’s beliefs, i.e. not the modal domain he believes he inherits. The main attitudinal comment is that within this remote sub-domain, the worlds that best fit the speaker’s (IRMWARE) expectations are those where JFK is assassinated by someone else.

(61i) (59i) Kennedy was assassinated because he had many enemies.
Kennedy kill-pssv-\( DEC_{\perp} \) enemy-many-have-\( FT_{\perp} \)
\[ \forall [x] [\text{kill}_{\text{FT}}(x, \top \delta)]; \forall [p] [p = \top \omega]; [w] \text{enemy}_{\text{Ser}}(\top \delta); [\top \omega] \subseteq \top \omega \]

(61ii) (59ii) If Oswald hadn’t killed him, someone else would’ve.
Oswald-\( ERG \) kill-prf-not-rem-\( HYPR_{\perp} \) 3S\( \perp \)
\[ ((([w] x = osw, \text{kill}_{\text{FT}}(x, \top \delta)); [w] \perp \omega); [\top \omega, \top \omega \in \perp \omega]; [\top \omega \in \text{MAX} \{\top \omega\}, \text{bel}_{\text{FT}} 1]); [\top \omega]; [\top \omega] \]

6.3 Projected consequences in remote modalities

Unlike stative att-suffixes (e.g. -suri ‘bel\( \perp \)’), which introduce attitude states, the implicitly attitudinal -galvar ‘rem’ only implies the existence of an attitude state without making it available for anaphora (e.g. temporal anaphora). The temporally explicit entry differs only in that the perspective point is a concurrent event (?\( \varepsilon \)) not the attitude holder (?\( \delta \)).

-rem \( \models \) \[ \lambda \varepsilon \lambda W. \lambda \alpha. \top \omega \varepsilon \perp \omega \in \top \omega]; [w] \notin \text{MAX} \{\top \omega\}, \text{attn}_{\text{FT}} \varepsilon \]

Temporal reference in discourse (58i, ii) is explicaded in (62i, ii) (building on (60i, ii)). (62ii) extends this analysis to the subordinated counterfactual (58iii), which on this account involves structured anaphora to a wished-for world and eventualty (\( \perp \omega \) and \( \perp \sigma \), adapting Brasoveanu 2007).
(62i) (58i) I have a wife, but no kid(s).

```
wife-have-rem-ELA-1s ...

([\{x\} \in \omega, \text{CTR } s = \text{CTR } T \in e, \omega \in \text{CTR } \delta, \omega \in \text{CTR } \theta_{\omega} s]; \land \omega, T \in \omega \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; [\text{CTR } \sigma \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; ...
```

... kid-have-not-DEC-1s ...

```
\ldots ([x \in \omega, \text{CTR } s = \text{CTR } T \in e, \text{kid}_{\omega} (\text{CTR } T \in e, \omega \in \text{CTR } \delta, \omega \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; [\text{CTR } s = \text{CTR } T \in e, T \in \omega \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; [\text{CTR } \sigma \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; ...
```

(62ii) (58ii) I wish I had a son.

```
son-have-rem-ELA-1s ...

\ldots ([\{s\} \in \omega, \text{CTR } T \in e, \text{son}_{\omega} (\text{CTR } T \in e, \omega \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; [\text{CTR } \sigma \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; ...
```

... fine-er-rem-DEC-1s ...

```
\ldots ([\{x\} \in \omega, \text{CTR } s = \text{CTR } T \in e, \text{des}_{\omega} (\text{CTR } T \in e, \omega \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; [\text{CTR } \sigma \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; ...
```

(62iii) (58iii) Then when I die, he would’ve been there for my wife.

```
then die-ERG ...

\ldots ([\{w\} \in \omega, \text{CTR } s = \text{CTR } T \in e, \text{be}_{\omega} (\text{CTR } T \in e, \omega \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; [\text{CTR } \sigma \in \omega [\omega] ]; [\land \omega, T \in \omega \in \omega [\omega] ]; ...
```

More precisely, in (62i) the modal base of -\textit{galuar} ‘rem’ is the set of worlds where the speaker is married (\land \omega). This set includes the real world (\land \omega), where the speaker is married at the time of this speech act (\land \omega). However, the real world is remote from the speaker’s wishes at the beginning of his marriage (\text{BEG} \land \sigma). It is also a world where his marriage is childless. This suggests that the real world is sub-optimal because the speaker’s marriage is childless, i.e. that he would prefer a wife-and-kid world to the real world.

The counterfactual (62ii) makes this explicit. The input modal base is the aforementioned domain (current \land \omega) where the speaker (CTR T \in e) has a wife. The topological hypothesis is the sub-domain where the wished-for (\land \sigma)-kid is a son, born (\text{BEG} \land \sigma) after the marriage ceremony (\text{BEG} \land \sigma). This topological sub-domain is remote from the wife-only sub-domain the speaker believes he inhabits. The attitudinal comment is that the speaker’s (CTR T \in e)-current wishes in the real world (\land \omega) rank any world (\land \omega) in this remote topological sub-domain (\land \sigma), where he also has a son, above the real world (\land \omega), where he only has a wife.

In the subordinated counterfactual (62iii) the initial modal anaphor (‘then’) zooms in on the wished-for worlds (\land \omega) and requires the rest of the counterfactual to elaborate (\land \omega). The antecedent clause introduces the event of the speaker’s death, and the subset of worlds where he dies as the topical sub-domain. Since all men are mortal, this subset consists of all
of the wished-for worlds. The main attitudinal comment refers to this topical sub-domain \((\top \omega)\). It projects an expected consequence of the speaker’s death in this sub-domain, which alas he does not believe he inhabits. In the expected worlds of this remote sub-domain, after the speaker’s death the son he wishes he had helped the wife he actually has.

The counterfactual Kennedy discourse (59i, ii) likewise projects an expected consequence in a modality the speaker does not believe to be his, but here viewed from a past perspective point. Temporal reference is analyzed in (63i, ii) (building on (61i, ii)).

(63i) (59i) Kennedy was assassinated because he had many enemies.

Kennedy-\(\tau\) kill-pssv-dec\(-3S\) enemy-many-have-fct\(-\tau3S\)
\(\tau[x; x = i,jk]; [e; \text{kill}_{\tau3S}(e, \text{CTR } e, \top \delta), \top \tau \subset i, \text{CTR } s, \text{CON } e, e \prec_{\tau3S} \top \tau] ; \tau[p; p = \top \omega]] ; [i; t \in \delta, \text{CON } s, \text{many.enemies}_{\text{n}}(\text{BCK } s, \top \delta, \text{CTR } s), \top \tau \subset i, \text{CON } \text{BEG } s] ; [\top \omega \subseteq \bot \omega]\)

(63ii) (59ii) If Oswald hadn’t killed him, someone else would’ve.

Oswald-erg\(\tau\) kill-prf-not-rem-hyp\(-\tau3S\)\(-3S\)…
\(((\{x; x = i, \text{osw}\}); [e; \text{kill}_{\tau}(e, \bot \delta, \top \delta); \{x; s = i, \text{CON } \bot e, \top \tau \subset i, \text{CTR } s\}; \{w; w \not\in \bot \omega]\}); \{\text{CTR } s = i, \bot \delta, \top \tau \subset i, \text{CTR } s\}; [\bot \omega, \top \omega \not\in \bot \omega] ; [\top \omega \not\in \bot \omega] ; [\text{BEG } \bot \sigma \prec_{\bot \omega} \text{BEG } \bot \sigma] ; [\bot \omega \not\in \bot \omega] ; [\top \omega = \bot \omega] ; [\{x; x = i, \top \delta\}; \ldots \text{man-bad-other-\tau3S} \ldots \text{erg-\tau prf-exp} \ldots \text{rem-dec}\(-\tau3S\)\(-3S\)
\(\ldots \tau[x; \text{man}_{\tau}(x, \bot \tau); \{\text{bad } \top \delta, \top \delta; \bot \omega, \bot \tau]; [\bot \delta, \epsilon \not\in \bot \delta]; [\top \delta = \bot \delta]; [e; \text{kill}_{\tau}(e, \top \delta, \bot \delta); \{x; s = i, \text{CON } \bot e]; [\bot \omega, \top \omega \not\in \bot \omega] ; [\top \omega \not\in \bot \omega] ; [\text{BEG } \bot \sigma \subset \bot \omega \text{CON } \text{BEG } \bot \sigma]; [\top \omega \not\in \bot \sigma]; [\text{BEG } \bot \sigma \prec_{\bot \omega} \text{end } s]; [\text{MAX } (\top \omega, \text{EXPR } \tau3S \bot \sigma \subseteq \bot \omega); [\top \tau \subset i, \text{CTR } s, \bot \sigma, \text{BEG } \bot \sigma \prec_{\tau3S} \top \tau] ; \tau[p; p = \top \omega]]\)

In (63i) the declarative clause outputs a common ground \((\top \omega)\) where JFK’s assassination is a \((\top e)\)-currently verifiable fact. The post-posed factual clause adds another currently verifiable fact as a possible cause—to wit, JFK’s enemies reaching critical mass \((\text{BEG } s)\). The resulting hate-filled state is realized in a larger class of worlds \((\bot \omega)\), and in every common ground world \((\top \omega)\) the time \((\bot \tau)\) of JFK’s assassination \((\top e)\) falls within the consequent time of the beginning of this hate-filled state \((\bot \omega)\).\(\text{CON } \text{BEG } s)\). In this context, the counterfactual (63ii) introduces a \((\top e)\)-real and a \((\top e)\)-current state of expectation. It projects an expected consequence of the aforementioned event of JFK’s enemies reaching critical mass \((\text{BEG } \bot \sigma)\) in the antecedent, \(\text{BEG } \bot \sigma\) in the consequent). The modal base for this expectation is the aforementioned set of worlds where this critical event is realized \((\bot \omega)\). The topical hypothesis introduced by the hypothetical mood is the subprocess—remote from the sub-domain the speaker believes to be his—where JFK is not assassinated by Oswald. The main attitudinal comment is that within this remote sub-domain \((\top \omega)\), the worlds that best fit the speaker’s current expectations are those where, in the wake of JFK’s enemies reaching critical mass, some other bad guy assassinates him.

In summary, Kalaalissut counterfactuals report attitudes to remote modalities. They involve an extra attitude, because the relation of modal remoteness is itself attitudinal. More precisely, the topical antecedent hypothesis and/or the scope of the attitudinal comment are
marked as remote (\textit{-galuar} ‘rem’) from an attitudinal ideal (e.g. beliefs or desires) of a current center of empathy, looking from a secondary perspective point. This secondary attitude report elaborates the main attitudinal comment about the topical antecedent hypothesis.

7 A CCG + UC fragment of Kalaallisut

To complete the analysis, I now show that the proposed UC representations can be derived from Kalaallisut discourse by universal directly compositional rules. To demonstrate that I define a fragment of Kalaallisut—rich enough to derive the counterfactual JFK discourse (59i, ii) and its UC representation (63i, ii)—in a framework that combines UC with the universal rules of Combinatory Categorial Grammar (CCG, Steedman 2000).

In CCG universal rules such as forward and backward function application (\(\rightarrow\), \(<\)) and composition (\(\rightarrow\mathbf{B}, <\mathbf{B}, \mathbf{<}\mathbf{B}\)) combine lexical items into well-formed interpreted strings.

- \(\mathbf{X/Y}: \beta_{ab}\) \(\mathbf{Y}: \alpha_{a} \rightarrow_{\mathbf{>} X: \beta x}\)
- \(\mathbf{Y}: \alpha_{a}\) \(\mathbf{X/Y}: \beta_{ab} \rightarrow_{< X: \beta x}\)
- \(\mathbf{X/Y}: \beta_{ab}\) \(\mathbf{Y/Z}: \alpha_{aw} \rightarrow_{\mathbf{B}} \mathbf{X/Z}: \lambda u. \beta(\alpha u)\)
- \(\mathbf{Y/Z}: \alpha_{aw}\) \(\mathbf{X/Y}: \beta_{ab} \rightarrow_{\mathbf{B}} \mathbf{X/Z}: \lambda u. \beta(\alpha u)\)
- \(\mathbf{Y/Z}: \alpha_{aw}\) \(\mathbf{X/Y}: \beta_{ab} \rightarrow_{\mathbf{B}} \mathbf{(X/Z)\mathbf:\alpha_{aw} X/Y}: \beta_{ab} \rightarrow_{\mathbf{B}} \mathbf{(X/Z)\mathbf:\alpha_{aw} \lambda u. \beta(\alpha u)}\)

The category \(s\) (sentence) is universal, but languages may differ on other categories as well as the category-to-type rule. For Kalaallisut, I propose an inventory of categories defined in K1 on the basis of the universal category sentence (\(s\)) plus three types of pronouns: individual (\(\text{pn}_{\text{st}}\)), modal (\(\text{pn}_{\text{st}}\)), and temporal (\(\text{pn}_{\text{st}}\)). The Kalaallisut category-to-type rule K2 requires sentences to translate into UC updates (type \([\ ] := (s)st\) and \(\alpha\)-pronouns into \(\alpha\)-projections (type \(s\alpha\)). (Note that types of the form \((a_{1}…(a_{n}\text{[}))\) are abbreviated as \([a_{1}…a_{n}]\).)

K1 (Kalaallisut categories)
- \(s\) and \(\text{pn}_{\text{st}}\), \(\text{pn}_{\text{st}}\), \(\text{pn}_{\text{st}}\), \(\text{pn}_{\text{st}}\) are Kalaallisut categories
- If \(X\) and \(Y\) are Kalaallisut categories, then so are \((X/Y)\) and \((X)\).

K2 (Kalaallisut category-to-type rule)
- \(\text{tp}(s) = [\ ]\), \(\text{tp}(\text{pn}_{\text{st}}) = s\alpha\)
- \(\text{tp}(X/Y) = \text{tp}(X) = (\text{tp}(Y) \text{ tp}(X))\)

ABBREVIATIONS (categories and types)
\[
\begin{align*}
\text{iv} & := s\text{ pn}_{\text{st}} & \text{sa} & := s\text{ pn}_{\text{st}} & \text{pn} & := \text{pn}_{\text{st}} & \text{D} & := s\delta & \text{w} & := s\omega \\
\text{iv} & := s\text{ pn}_{\text{st}} & \text{cns}_{\text{st}} & := (s\text{ pn}_{\text{st}})\text{ pn}_{\text{st}} & \text{cn} & := \text{cn}_{\text{st}} & \text{T} & := s\tau & [\ ] & := (s)st
\end{align*}
\]

Kalaallisut has four categories of roots: \textit{intransitive verbs} (\text{iv}⟨\text{pn}⟩), \textit{transitive verbs} (\text{iv}⟨\text{pn}⟩), \textit{common nouns} (\text{cn}_{\text{st}}), and \textit{relational nouns} (\text{cn}_{\text{st}}⟨\text{pn}⟩). Transitive verbs and relational nouns have an extra argument (object \(y\) or possessor \(z\)), so they require an extra pronoun (\(\text{pn}\)).
Time and modality without tenses or modals

Morphologically, verbal roots inflect for mood. Semantically, they introduce eventualities into discourse. In contrast, nominal roots inflect for case. Unlike verbs, they have a temporal argument (\( \tau \)), which can be saturated by derivation (e.g. -gar ‘-have’) or case inflection. The primary (last) argument of a verbal root is the world of evaluation (\( w_o \)). Nominal roots have primary arguments of various types: an individual for cn\(_0\) (e.g. inak- ‘man’), a time for cn\(_1\) (e.g. ullaq- ‘day’), or a world for cn\(_2\) (e.g. isuma- ‘idea’). This interacts with lexical recentering, which can help to saturate the primary argument (see lexical recentering operators, \(^*\) and \(^-\)\(^*\), below).

Kalaallisut is a polysynthetic language, with hundreds of derivational suffixes. It builds words compositionally, just like English builds sentences. Morphologically complex bases always allow further derivation, because derivational suffixes operate within the space of root categories. That is, a derivational suffix attaches to an input base of a root category and derives an output base of a root category. Kalaallisut att-suffixes interact with negative suffixes (‘-not’, ‘-rem’) in a way similar to English neg-raising (Observation 5). I attribute this to additional neg-raising entries for negative suffixes (e.g. ‘+rem’), which enable them to form complex predicates with att-suffixes (e.g. ‘-exp+rem’), in effect reversing the relative scope within the complex. (Note that in all lexical entries, \( \eta, \eta' \in \{ \epsilon, \sigma \} \).)

Verbal bases inflect for mood. The output is not a root category, so it can only feed into further inflection. The declarative matrix mood (-DEC) asserts that the iv-event (\( \text{EVT} \perp \eta \)) is a currently verifiable fact. It also introduces the updated common ground (\( \sqcup \sigma \)) as the new primary topic (the truth-set of the declarative statement). The dependent factual mood (-FCT) introduces a background fact (\( \text{EVT} \perp \eta' \)) which is realized throughout the matrix common ground and may have caused the matrix event (\( \text{EVT} \perp \eta \)). The dependent hypothetical mood (-HYP) forms a modal topic-comment sequence (\( \eta' \)) with the verbal base (\( s \)) of
the modified verb. The modal topic is the sub-domain of the modal base (\(\omega\)) where the antecedent prospect, viewed from a salient perspective point (\(\rho\)), is realized.

\[-\text{DEC} \quad \vdash s\langle x\rangle p n (p) \quad [\lambda x (\omega x \wedge (\rho x \wedge \theta x \wedge \eta x \wedge \tau x))] \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]; \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]]
\]

\[-\text{FCT} \quad \vdash (s\langle s\rangle) p n (p) \quad [\lambda x (\omega x \wedge (\rho x \wedge \theta x \wedge \eta x \wedge \tau x))] \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]; \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]
\]

\[-\text{HYP} \quad \vdash (s\langle s\rangle) p n (p) \quad [\lambda x (\omega x \wedge (\rho x \wedge \theta x \wedge \eta x \wedge \tau x))] \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]; \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]
\]

The mood inflection is followed by one or two pronominal suffixes (category \(x\langle x\rangle p n\), with \(s \in \{s, s', s\prime, \text{s/\prime}, \text{s\prime/s}\}\)) for subject pronouns). That is why an inflected matrix verb in Kalaallisut is a complete sentence (see Jelinek 1984 on pronominal argument languages). Possessors of relational nouns are likewise saturated by pronominal suffixes. Third person pronouns are either topical or backgrounded. Typically, they are interpreted as top or bottom anaphors that saturate the current argument slot. Alternatively, they may update the centering status of that argument (e.g., in the antecedent of (59ii)), the suffix ‘-3s’ fills the object slot with the input topic, JFK, and demotes JFK to the status of background.)

\[-3s_1 \quad \vdash x(s\langle x\rangle p n) \quad [\lambda x (\omega x \wedge (\rho x \wedge \theta x \wedge \eta x \wedge \tau x))] \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]; \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]
\]

Nominal bases inflect for case. The direct cases (absolutive and ergative) form s-modifiers. These pseudo ‘subjects’ and ‘objects’ set the topic or background for an anaphoric pronominal suffix, which is the true argument of the predicate in the modified sentence.

\[-\text{\(\text{O}^\top\), } \text{ERG}^\top \quad \vdash (s\langle s\rangle) c n (p) \quad [\lambda x (\omega x \wedge (\rho x \wedge \theta x \wedge \eta x \wedge \tau x))] \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]; \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]
\]

Kalaallisut is topic-prominent and polysynthetic. I attribute these typological traits partly to lexical entries, such as the above, and partly to lexical recentering (\(\tau\langle \cdot \rangle\), \(\eta\langle \cdot \rangle\)) and type lifting (\(\langle \cdot \rangle\), \(\langle \cdot \rangle\)). Type lifting by \(\langle \cdot \rangle\) turns s-modifiers (\(s\langle s\rangle\)) into verbal base modifiers (\(s\langle s\rangle\)), whereas \(\tau\langle \cdot \rangle\) makes verbal bases (\(s\langle s\rangle\)) accessible to word-external modifiers.

\[\tau\langle \cdot \rangle \quad \vdash s\langle s\rangle c n \quad [\lambda x (\omega x \wedge (\rho x \wedge \theta x \wedge \eta x \wedge \tau x))] \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]; \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]
\]

\[\eta\langle \cdot \rangle \quad \vdash s\langle s\rangle c n \quad [\lambda x (\omega x \wedge (\rho x \wedge \theta x \wedge \eta x \wedge \tau x))] \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]; \quad [\lambda t \eta (\rho t \wedge \theta t \wedge \eta t \wedge \tau t)]
\]

In this fragment, discourse (59ii) can be derived as follows. Complex words are incrementally built and translated into UC by universal rules of backward application and composition (\(<\), \(<\text{B}\), and \(<\text{B}\) B). For example, sentence (59i) consists of three words, which are built in (64a) and (65a); the resulting translations (b) are equivalent to (c). Words are
then combined, incrementally left-to-right, into sentences. For discourse (59i, ii) the two component sentences are built in (64)–(66) and (67)–(73), respectively.

\[
\begin{array}{cccccc}
(64) & a. & \text{Kennedy-} & \tau(\cdot) & -\Theta & \text{kill-} \\
& & \text{cn} (= s_s\langle p_n\rangle\langle p_n\rangle) & s_s\langle s_s\rangle & iv\langle\langle p_n\rangle\rangle & \text{iv} < B \\
& & \text{cn} & < & \langle s_s\rangle & \text{cn} < B \\
& b. & \text{enemy-} & \text{-many} & \text{-have} & \text{-FCT}_T & \text{-3S}_T \\
& & \text{cn\langle p_n\rangle} & \text{cn\langle cn\langle p_n\rangle\rangle} & \text{iv\langle\langle p_n\rangle\rangle} & \langle s_s\rangle\langle s_s\rangle\langle\langle p_n\rangle\rangle \langle\langle s_s\rangle\rangle < B \\
& & \text{cn\langle p_n\rangle} & < & \langle s_s\rangle\langle s_s\rangle\langle\langle p_n\rangle\rangle \langle\langle s_s\rangle\rangle < B \\
& c. & \lambda K_2; \lambda K_3; & \lambda K_4; & \lambda K_5; & \lambda K_6; & \lambda K_7; & \lambda K_8; & \lambda K_9; & \lambda K_{10}; & \lambda K_{11}; & \lambda K_{12}; & \lambda K_{13}; & \lambda K_{14}; & \lambda K_{15}; & \lambda K_{16}; \\
\end{array}
\]

(65) \( \Rightarrow \) (33i)

\[
\begin{array}{cc}
(66) & (64) \Rightarrow \text{s} (65i) \\
(67) & \text{(Oswald-ERG)} \Rightarrow \text{s}: \langle x = \text{osw} \rangle \Rightarrow \text{V w} \\
(68) & \tau(\text{-kill})-\text{not-rem-HYP}_\text{i-3S}_\text{j-3S}_\text{k} \Rightarrow \text{prf}\langle x = \text{osw} \rangle \Rightarrow \text{V w} \\
\end{array}
\]
(69) \( (67) \ (68) \ \Rightarrow \ s/s' : \Box \lambda \bar{w}_w \lambda \bar{w}_w. \ ((\{x \mid x = \text{osw}\}; [e \ w \mid \text{kill}_w(e, \perp \delta, \top \delta)]; [s \ s = \text{CON} \perp \epsilon, \top \tau \in \iota, \delta \omega \in \iota \ \omega \ s]; [w \ w \in \perp \omega \iota \tau]; [s \ \text{CTR} \ s = \iota \perp \delta, \top \tau \in \perp \iota \omega \ s]; [\perp \omega, \top \omega \in \perp \omega \io]; [\perp \omega \ \not\in \ \text{MAX} \{\perp \omega \io\}, \text{bel}_{\top \omega} \top \epsilon]); [\text{BEG} \perp \sigma \iota \perp \omega \ \text{BEG} \perp \sigma]; \top {[p \ p = \perp \omega]} \top ; (\{x \mid x = \top \delta \} \perp ; \top \omega \ w) \)

(70) \( (\text{man-bad-other-3S\_2\_ERG})^+ \ \Rightarrow \ s/s' : \Box \lambda \bar{w}_w \lambda \bar{w}_w. \ ((\{x \mid x = \text{man} \omega \ \perp \tau\}; [\text{bad} \top \delta, \top \delta \not\in \perp \delta \iota]; [\perp \delta \iota \in \top \delta \iota]; [\top \delta \ i \not\in \perp \delta \iota]) \top ; \top \omega \ w) \)

(71) \( (69) \ (70) \ \Rightarrow \ s/s' : \Box \lambda \bar{w}_w \lambda \bar{w}_w. \ ((\{x \mid x = \text{osw}\}; [e \ w \mid \text{kill}_w(e, \perp \delta, \top \delta)]; [s \ s = \text{CON} \perp \epsilon, \top \tau \in \iota, \delta \omega \in \iota \ \omega \ s]; [w \ w \in \perp \omega \iota \tau]; [s \ \text{CTR} \ s = \iota \perp \delta, \top \tau \in \perp \iota \omega \ s]; [\perp \omega, \top \omega \in \perp \omega \io]; [\perp \omega \ \not\in \ \text{MAX} \{\perp \omega \io\}, \text{bel}_{\top \omega} \top \epsilon]); [\text{BEG} \perp \sigma \iota \perp \omega \ \text{BEG} \perp \sigma]; \top {[p \ p = \perp \omega]} \top ; (\{x \mid x = \top \delta \} \perp ; \top \omega \ w) \)

(72) \( \text{‘(kill-prf-exp’+rem)-DEC\_2\_3S-3S} \ \Rightarrow \ s(s'/s) : \Box \lambda \bar{w}_w \lambda \bar{w}_w. \ ((\{e \mid \text{kill}_w(e, \perp \delta, \top \delta); [s \ s = \text{CON} \perp \epsilon]; [\perp \omega, \top \omega \in \perp \omega \io]; [\perp \omega \ \not\in \ \text{MAX} \{\perp \omega \io\}, \text{bel}_{\top \omega} \top \epsilon]); [\text{BEG} \perp \sigma \iota \perp \omega \ \text{CON} \ \text{BEG} \perp \sigma]; [s \ \text{BEG} \perp \sigma \ \text{END} \ s]; [\text{MAX} \{\top \omega, \text{exp}_w \perp \sigma \} \perp \perp \sigma \iota \io \perp \omega]; [\top \tau \ \tau \iota, \delta \omega \ \perp \sigma, \text{BEG} \perp \sigma \ \text{bel}_{\top \sigma} \top \epsilon]; \top {[p \ p = \top \omega]} \top \)

(73) \( (71) \ (72) \ \Rightarrow \ s : (63ii) \)

In general, a Kalaallisut sentence consists of a saturated matrix verb (category s or type- lifted s'(s/s)) plus any number of dependents, interpreted as modifiers (s/s, s's, or s's). Most dependents precede the matrix verb, but one or two may be post-posed (as in (66)). Multiple dependents on the same side of the matrix verb compose (by >B or <B) into a dependent cluster (as in (71)), which then combines with the matrix verb like a single dependent (by > or <, as in (73)). This left-to-right incremental analysis correctly predicts one more typological trait of Kalaallisut—to wit, the ‘free’ order of the dependents of a matrix verb. All of the example discourses in Sections 1–6 can be incrementally composed in this way. Thus, the proposed UC representations can be derived from Kalaallisut discourse by universal directly compositional rules of CCG.

8 From Kalaallisut to English

Typologically, Kalaallisut is a mood-based topic-preeminent language with massively poly-synthetic morphology and ‘free’ word order. At the other extreme, English is a tense-based subject-prominent language with analytic morphology and rigid word order. As a consequence, none of the Observations 1–6 about the syntax-semantics interface extend to English. Unlike Kalaallisut, English has no fact-oriented mood, no prospect-oriented hypothetical mood, no prospect-oriented attitudinal correlate requirement, and no translation equivalent for the remoteness suffix -galuar ‘rem’.

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Nevertheless, I propose that in English, too, reference to real and hypothetical past, present, and future, involves centering-based modal and temporal anaphora. This proposal builds on a CCG + UC fragment of English presented in Bittner (2009), which implements an influential theory of tense as temporal anaphora (Partee 1973, 1984) plus temporal update (Webber 1988). Here, I also implement a version of Stone’s (1997) idea that, in addition to anaphoric tenses, English has a parallel system of anaphoric modals. As in Kalaalit, universal CCG rules translate English discourses into UC. For instance, discourse (74i, ii) translates into (75i, ii), given lexical entries exemplified below. (Note that unlike Kalaalit, which employs a global update, \([A\hat{w} / A, T]\), English uses a local condition, \(A\hat{w} (A, T) := \hat{A}((\text{EVT} \ A j = A j \rightarrow \partial_{\eta} A j \subset T j) \land (\text{STA} \ A j = A j \rightarrow T j \subset \partial_{\eta} A j)).\))

(74) i. Jim leaves today.
ii. Sue will be upset.

\[
\begin{align*}
\text{leave} & : \lambda w. \{e \text{ leave}\}_e(e, CTR e) \\
\text{~TNS} & : iV \lambda w. \lambda u, \lambda w. \{\partial e \rightarrow \tau \subseteq \tau\}; \{w \in \tau \omega\}; \{Ur \leftarrow \partial_e \land \tau\}, \\
& \text{TNS} \; (\land \eta = \lambda\hat{z}) \\
\text{FUT} & : iV \lambda w. \lambda u, \lambda w. \{\partial e \rightarrow \tau < \tau\}; \{w \in \tau \omega\}; \{Ur \leftarrow \partial_e \land \tau\}, \\
& \text{FUT} \; (\land \eta = \lambda\hat{z}) \\
\text{Jim} & : \lambda w. \lambda u, \lambda w. \{x \mapsto \text{Jim}\}; \tau \rightarrow \delta w \\
\text{today} & : \lambda w. \lambda u, \lambda w. \{x \mapsto \text{today}\}; \tau \rightarrow \delta w \\
(\cdot) & : \lambda w. \lambda u, \lambda w. \{t \mapsto \text{today}\}; \tau \rightarrow \delta w \\
(\cdot) & : \lambda w. \lambda u, \lambda w. \{t \mapsto \text{today}\}; \tau \rightarrow \delta w
\end{align*}
\]

(75) i. Jim (\(\text{today}\)) today.
ii. Sue be-\(\text{upset}\).

I assume that the discourse-initial default state is universal (\(\text{init}(p_0, e_0)\), defined in D7, implementing the ‘commonplace effect’ of Stalnaker 1978). In particular, the default topic time is the speech instant (\(\partial_e \rightarrow \tau\)). Since this cannot properly include anything, a topical future period must be introduced in (75i) (by \(\text{~FUT}(\cdot)\)), to satisfy the local AT-condition and the non-past tense (\(-\text{TNS}\)). The event of Jim’s arrival is properly included within this topical future. In addition, tense on an event verb may update the topic time to the consequent time (by \(\text{~FUT}(\cdot)\)), as in (75i). This temporal update does not affect post-verbal modifier today, which constrains the eventuality (Jim’s arrival), not the topic time. In English, illocutionary force is in part marked by prosody. The full stop prosody ‘\(\cdot\)’ turns a sentence radical (\(s\)) into a declarative sentence (\(s\)), by prediching the radical of the topic world (\(\tau \omega\)) and introducing the updated common ground (\(\tau \omega\)) as the new primary topic (adapting Stalnaker 1975). On this analysis, the indicative is not a fact-oriented mood, but a modal default.
The salient reading of (74ii) is explicated in (75ii). The future auxiliary will requires a future topic time and a vivid world of evaluation, i.e., a world within the common ground (\( \top \omega \)), adapting Stone (1997). In (75ii) both of these tests are passed, by the topical future following Jim’s departure (\( \top \tau \)) and the topic world (\( \top \omega \)). In the common ground worlds that survive the assertion of (75ii) Sue is sad at that topical future time. Thus, in root clauses will does not involve any modal quantification. All that matters is the actual future of the speech world (\( \top \omega \), adapting Kamp and Reyle (1993, who only consider this world).

In contrast, in conditionals will quantifies over branching futures (adapted bloom 1984), because the complementizer if builds a modal topic-comment sequence. The antecedent of will introduces a topical set of vivid futures and will, as part of the comment, quantifies over this set. English if does not require any attitudinal correlate because it is itself implicitly attitudinal (cf. Kratzer 1981), unlike the hypothetical mood in Kalaallisut.

\[
\text{if } \pi \vdash (s/g)^\emptyset; (T_\omega;V_\omega;\lambda_\omega;((L_0 \cup \alpha, \tau)p = \bot \omega)) \Gamma; (L_\omega \cup \alpha, [\max(\top \Omega, att_\omega ? e) \subseteq \bot \omega])
\]

For example, the conditional variant of discourse (74ii, ii) translates into (76). The non-past antecedent (if Jim leaves...) introduces a topical sub-domain of the common ground (\( \top \omega \)), adapting Stalnaker (1975), where Jim leaves at a future topic time (introduced by \( \top \tau \), as in (75ii)). The topical future for the attitudinal comment is the consequent time of this event (introduced by (\( \cdot \))\( ^\tau \), as in (75ii)). The attitudinal comment (...Sue will be upset) is analyzed as a prediction, i.e., the implicit attitude of if is resolved to expectation (exp) and the perspective point, to the speech act (\( \top \epsilon \)). In the antecedent worlds that best fit the speaker’s expectations Sue is sad at that future time, i.e. in the wake of Jim’s departure.

(76) \( ^\tau \text{if Jim } ^\tau(\text{leave-TNS}) \) …

(77) i. I want Jim to win tomorrow.
    ii. If he lost, Sue {would | might} get upset.

Iatridou (2000) shows that past tense marking is used in this way in unrelated languages all over the world, so it cannot be chance. She proposes that past tense can indicate either that ‘the topic time excludes the utterance time’ (p. 246) or that ‘the topic worlds exclude the actual world’ (p. 247). This proposal is both too weak (not now does not mean past) and too strong (undesirable does not mean not actual, alas), but the basic idea is attractive.
Building on that, I propose that past tense (-TNS) requires precedence—either the topic time precedes the perspective time in the temporal order, or the world of evaluation precedes (ranks below) the perspective world in a salient attitudinal order. The latter reading may be forced by a future-oriented remote modals that likewise requires remoteness (e.g. FUTrem or MAYrem).

\[-\text{TNS}\]  
\[\text{iv}^\text{S}: \mathcal{L}_w^\text{S}\mathcal{L}_w^\text{S}\mathcal{L}_w^\text{S}. [T \tau < \theta], \theta = \tau]; [w \in \tau \theta]; (V \wedge \downarrow; [\mathcal{A}_w(\downarrow a, \tau \tau), CTR \downarrow a = \mathcal{A}(\tau \tau)])

\[-\text{FUT}\]  
\[\text{iv}^\text{S}: \mathcal{L}_w^\text{S}\mathcal{L}_w^\text{S}\mathcal{L}_w^\text{S}. [\theta \tau > \theta \tau]; [w \in \tau \theta]; (V \wedge \downarrow; [\mathcal{A}_w(\downarrow a, \theta \tau), CTR \downarrow a = \mathcal{A}(\theta \tau)])

\[-\text{MAY}\]  
\[\text{iv}^\text{S}: \mathcal{L}_w^\text{S}\mathcal{L}_w^\text{S}\mathcal{L}_w^\text{S}. [\theta \tau > \theta \tau]; [w \in \tau \theta]; (V \wedge \downarrow; [\mathcal{A}_w(\downarrow a, \theta \tau), CTR \downarrow a = \mathcal{A}(\theta \tau)])

On this analysis of ‘fake past’ and future-oriented remote modals, discourse (77i, ii) translates into (78i, ii). In the output of (78i) throughout the common ground (\(\tau \theta\)), the speaker is in a current state of desire whose modal base is the initial common ground (default \(\tau \Omega\)). In the top-ranked \((\tau \Omega)\)-worlds Jim wins the day after this speech act (\(\tau \epsilon\)-tomorrow). In the follow-up conditional (78ii), the topical antecedent hypothesis is the less desirable sub-domain, relative to the winning worlds (\(\downarrow \omega\)), where Jim loses the aforementioned (\(\downarrow \tau\))-competition. The topic time for the matrix comment is the consequent time of that defeat. This topical future (\(\tau \tau\)) and the remote hypothetical worlds (\(\downarrow \omega\)) satisfy the tests of the matrix modal (\(\text{would or might}\)). If the modal is \(\text{would}\), then the main attitudinal comment is that, within the antecedent modality where Jim loses (current \(\tau \Omega\)), in the worlds the speaker considers most likely Sue gets upset during the consequent time of Jim’s defeat. If the modal is \(\text{might}\), then this holds for a non-empty sub-domain of the antecedent losing modality.

(78)  
i. I want\(_{\text{-TNS}}\) Jim\(_{\text{+}}\) INF win-\(\downarrow\) tomorrow\(_{\text{+}}\).
\[\theta = \tau; [\tau \omega \in \tau \theta]; [x \epsilon = \text{Jim}]; [e \in \text{win}\_\epsilon; \downarrow \delta], \theta = \tau \leq \text{day.after} (\theta \tau \epsilon); [s \epsilon; \theta _\omega \leq \tau \leq t, \theta _\omega \leq \text{beg} \leq \epsilon]; [\text{MAX}\_\tau \omega, \text{des} \_\omega \leq \epsilon]; [\tau \epsilon \leq \tau \theta], \theta = \tau \leq \epsilon; CTR \leq \sigma = \text{CTR} \tau \epsilon; \tau; [p \leq \tau \theta]]

ii. if he (lose\(_{\text{-TNS}}\)) \(\tau\) ...
\[\quad (\tau; [\xrightarrow{\tau} \text{win}]; [\text{des} \_\tau \theta \epsilon; \downarrow \delta], \theta = \tau \leq \text{day.after} (\theta \tau \epsilon); [s \epsilon; \theta _\omega \leq \tau \leq t, \theta _\omega \leq \text{beg} \leq \epsilon]; [\text{MAX}\_\tau \omega, \text{des} \_\omega \leq \epsilon]; [\tau \epsilon \leq \tau \theta], \theta = \tau \leq \epsilon; CTR \leq \sigma = \text{CTR} \tau \epsilon; \tau; [p \leq \tau \theta]]

… Sue FUT\(_{\text{rem}}\) get-\(\downarrow\) upset (if i) .
\[\quad (\tau; [\text{win}]; [\text{des} \_\tau \theta \epsilon; \downarrow \delta], \theta = \tau \leq \text{day.after} (\theta \tau \epsilon); [s \epsilon; \theta _\omega \leq \tau \leq t, \theta _\omega \leq \text{beg} \leq \epsilon]; [\text{MAX}\_\tau \omega, \text{des} \_\omega \leq \epsilon]; [\tau \epsilon \leq \tau \theta], \theta = \tau \leq \epsilon; CTR \leq \sigma = \text{CTR} \tau \epsilon; \tau; [p \leq \tau \theta]]

… Sue MAY\(_{\text{rem}}\) get-\(\downarrow\) upset (if i) .
\[\quad (\tau; [\text{win}]; [\text{des} \_\tau \theta \epsilon; \downarrow \delta], \theta = \tau \leq \text{day.after} (\theta \tau \epsilon); [s \epsilon; \theta _\omega \leq \tau \leq t, \theta _\omega \leq \text{beg} \leq \epsilon]; [\text{MAX}\_\tau \omega, \text{des} \_\omega \leq \epsilon]; [\tau \epsilon \leq \tau \theta], \theta = \tau \leq \epsilon; CTR \leq \sigma = \text{CTR} \tau \epsilon; \tau; [p \leq \tau \theta]]
On this analysis, conditionals are a species of attitude reports not only in Kalaallisut but also in English, albeit with different details. This proposal is admittedly less compelling for English than for Kalaallisut, but it is compatible with some influential English-based theories of attitudes as well as indicative and counterfactual conditionals (e.g. the theories cited above). Some seemingly conflicting claims about English (e.g. Thomason 1984 vs. Kamp and Reyle 1983 on the future will) are reconciled as context-dependent special cases of this cross-linguistic proposal. This proposal also explains the widespread use of ‘fake past’ in remote conditionals, by extending the standard theory of past tense as temporal precedence to a parallel theory of remoteness as attitudinal precedence.

A general point illustrated by this cross-linguistic study is that languages may fundamentally disagree on grammatical means, like Kalaallisut and English on all the major typological traits. Therefore, they may disagree on observations about the syntax-semantics interface, like Kalaallisut and English on all of the Observations 1–6. Such systematic differences may amount to genuinely different grammatical systems for discourse reference to real and hypothetical past, present, and future.

English, with its parallel system of anaphoric tenses and modals, treats time and modality as two essentially independent dimensions. Eventualties are located at a certain time in a certain set of worlds. Accordingly, English-based theories of temporal reference generally treat it as independent of modal reference and vice versa. In contrast, the mood-based system of Kalaallisut is centered around the notion of a currently verifiable fact from the perspective of a certain event. That event (e₀) is located in some world at some time and to be currently verifiable from that perspective means to precede that event in time in the same world (e ≤₀ e₀ : = [d][w](e) ≤₁ [d][w](e₀)). In this system it is possible to analyze modal reference independently of temporal reference, as we have done throughout this study. However, the analysis of temporal reference must first of all explicate the relevant perspectival discourse referents. And then it must necessarily build on modal reference to locate the related currently verifiable facts as well as current prospects, i.e. events that may become currently verifiable facts in some modality, viewed from a future perspective point.

Nevertheless, if we take each language at face value and interpret it exactly as is, then we may find that even languages with fundamentally different grammatical systems still agree on semantic universals. For example, even Kalaallisut and English agree on the basic ontology of individuals, times, events, states, and worlds, and on centering-based discourse anaphora across these semantic domains. As a consequence, by different grammatical means, both languages converge on similar truth conditions for discourses about real and hypothetical past, present, and future, which both languages treat as centering-based discourse anaphora to individuals, times, events, states, and worlds.

References


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