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Tense, mood, and centering[1]

1. Introduction

Natural languages exhibit a great variety of grammatical paradigms. For instance, in English verbs are grammatically marked for tense, whereas in the tenseless Eskimo-Aleut language Kalaallisut they are marked for illocutionary mood. Although time is a universal dimension of the human experience and speaking is part of that experience, some languages encode reference to time without any grammatical tense morphology, or reference to speech acts without any illocutionary mood morphology.

Nevertheless, different grammatical systems are semantically parallel in certain respects. Specifically, I propose that English tenses form a temporal centering system, which monitors and updates topic times, whereas Kalaallisut moods form a modal centering system, which monitors and updates modal discourse referents. To formalize these centering parallels I define a dynamic logic that represents not only changing information but also changing focus of attention in discourse (*Update with Centering*, cf. Grosz *et al* 1995). Different languages can be translated into this logic in a directly compositional way by the universal rules of *Combinatory Categorial Grammar* (CCG, Steedman 2000)

The resulting centering theory of tense and illocutionary mood draws semantic parallels across different grammatical systems. The centering generalizations span the extremes of the typological spectrum, so they are likely to be universal. In addition, the theory accounts for the translation equivalence of tense and illocutionary mood in a given utterance context. Following Stalnaker (1978) I assume that the very act of speaking up has a 'commonplace effect' on the context. It focuses attention on the speech act and thereby introduces default modal and temporal topics. These universal defaults complement language-specific grammars, e.g. English tenses and Kalaallisut moods. In a given utterance context the universal discourse-initial defaults plus language-specific grammatical marking may add up to the same truth conditions. Thus, different forms may converge on the same semantics.

The paper is organized as follows. Section 2 defines Update with Centering (UC). In particular, we define a universal ontology of discourse objects and formalize Stalnaker's (1978) 'commonplace effect' as a discourse-initial attention update that introduces default modal and temporal topics. Section 3 recasts the anaphoric theory of English tenses as centering-based temporal anaphora. Section 4 analyzes illocutionary mood in Kalaallisut as centering-based modal anaphora. Section 5 shows that, given the discourse-initial modal and temporal defaults, the mirror-image centering systems of English tenses and Kalaallisut moods converge on equivalent truth conditions, up to a point. Section 6 concludes.

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2. Update with Centering

According to Stalnaker (1978:323), the very act of speaking up has a ‘commonplace’ effect on the context. In Stalnaker’s own words:

> “When I speak I presuppose that others know I am speaking…This fact, too, can be exploited in the conversation, as when Daniels says *I am bald*, taking it for granted that his audience can figure out who is being said to be bald. I mention this COMMONPLACE way [MB emphasis] that assertions change the context in order to make it clear that the context on which assertion has its ESSENTIAL effect is not defined by what is presupposed before the speaker begins to speak, but will include any information which the speaker assumes his audience can infer from the performance of the speech act.”

The ‘essential’ effect of assertion is to update the common ground based on what is said. The common ground is the set of worlds that are live candidates for the speech world. After the ‘commonplace’ effect the common ground consists of those worlds that are compatible with ‘what is presupposed before the speaker begins to speak’ plus the information about the speech act. For every proposition that is then expressed by the speaker, the input common ground is updated to the subset consisting of those worlds that are compatible with the new proposition. In this way Stalnaker (1978) represents growth of information.

This strategy works for discourse-initial sentences but it runs into problems with connected discourses, such as *A man came in. He sat down*. For in order to determine what proposition is expressed by the second sentence, *He sat down*, it is necessary to deal with the nominal anaphora by the pronoun, *he*, and the temporal anaphora by the past tense, *sat.* To address this problem, while preserving Stalnaker’s insight, I define an update semantics that combines prominence-based discourse anaphora—along the lines of Dekker’s (1994) *Predicate Logic with Anaphora* (PLA)—with many-sorted type theory. The resulting *Update with Centering* (UC) can be defined in a manner parallel to Dekker’s definition of PLA, as follows.

Like PLA, UC represents changing states of information and attention (*infotention*) in discourse. A state of infotention is a set of *lists* of prominence-ranked semantic objects that can currently antecede discourse anaphors. Refining PLA, a UC-list is structured into a top sub-list of prominence-ranked *topical* objects (in the current center of attention) and a bottom sub-list of prominence-ranked *background* objects (currently in the periphery).

DEFINITION 1 (Lists and infotention states) Let D be a non-empty set of objects.

- $\langle D\rangle^{n,\,m} = D^n \times D^m$ is the set of $\top\bot$*-lists* of n topical objects and m background objects
- For any $\top\bot$-list $\mathsf{i} = \langle \mathsf{i}_1, \mathsf{i}_2\rangle \in \langle D\rangle^{n,\,m}$, $\top\mathsf{i} = \mathsf{i}_1$ and $\bot\mathsf{i} = \mathsf{i}_2$. Thus, $\mathsf{i} = \langle \top\mathsf{i}, \bot\mathsf{i}\rangle$.
- An n, m*-infotention state* is any subset of $\langle D\rangle^{n,\,m}$. The null set, $\varnothing$, is the *absurd state.*

A state of infotention about n topical and m background objects can be pictured as a two-dimensional matrix (e.g. (1)). Each row represents a possible topic-background-list—i.e. a pair of a top-ranked list of n topical objects and a botom-ranked list of m background objects. Each column represents the set of objects at a particular prominence rank—e.g. the primary topic ($\top_1$), the secondary topic ($\top_2$), the primary background ($\bot_1$), etc.

(1)
$$\begin{array}{l} \langle\langle \mathsf{d}_{\top 1}, \ldots, \mathsf{d}_{\top n}\rangle, \langle \mathsf{d}_{\bot 1}, \ldots, \mathsf{d}_{\bot m}\rangle\rangle \\ \langle\langle \mathsf{d}'_{\top 1}, \ldots, \mathsf{d}'_{\top n}\rangle, \langle \mathsf{d}'_{\bot 1}, \ldots, \mathsf{d}'_{\bot m}\rangle\rangle \\ \langle\langle \mathsf{d}''_{\top 1}, \ldots, \mathsf{d}''_{\top n}\rangle, \langle \mathsf{d}''_{\bot 1}, \ldots, \mathsf{d}''_{\bot m}\rangle\rangle \end{array}$$

An infotention state like (1) contains the information that the primary topic is a man just in case every object in the $\top_1$-set (column) is a man. Furthermore, the state contains the information that the primary background object is a donkey owned by the topical man just in case in every list (row) the $\bot_1$-object is a donkey owned by the $\top_1$-man.

A piece of discourse deterministically updates the input state of infotention to the output state. Information update eliminates the $\top\bot$-lists that are incompatible with the new information. For instance, if (1) is updated with the information that the topical man beats the background donkey then the $\top\bot$-lists that do not fit this constraint will be eliminated:

(2) $\langle\langle \mathsf{d}_{\top 1}, \ldots, \mathsf{d}_{\top n}\rangle, \langle \mathsf{d}_{\bot 1}, \ldots, \mathsf{d}_{\bot m}\rangle\rangle$
$\langle\langle \mathsf{d}''_{\top 1}, \ldots, \mathsf{d}''_{\top n}\rangle, \langle \mathsf{d}''_{\bot 1}, \ldots, \mathsf{d}''_{\bot m}\rangle\rangle$

Attention update involves recentering—that is, extending the input $\top\bot$-lists with newly prominent discourse objects. These can be new objects, freshly introduced into the discourse; or familiar objects, reintroduced by definite descriptions or other anaphors. For instance, if the next sentence begins with *The donkey*... then the background $\bot_1$-donkey of the input will be promoted to topical status. This attention update will yield an output state where in each $\top\bot$-list (row) the $\bot_1$-donkey from the input is added to the top list as the new primary topic (new $\top_1$-object). Other topical objects are thereby demoted one notch.

(3) $\top_1 \quad \top_2 \quad \top_{n+1} \quad \bot_1 \quad \bot_m$ ← prominence rank
$\langle\langle \mathsf{d}_{\bot 1}, \mathsf{d}_{\top 1}, \ldots, \mathsf{d}_{\top n}\rangle, \langle \mathsf{d}_{\bot 1}, \ldots, \mathsf{d}_{\bot m}\rangle\rangle$
$\langle\langle \mathsf{d}''_{\bot 1}, \mathsf{d}''_{\top 1}, \ldots, \mathsf{d}''_{\top n}\rangle, \langle \mathsf{d}''_{\bot 1}, \ldots, \mathsf{d}''_{\bot m}\rangle\rangle$

To analyze modal and temporal centering discourse referents ($\mathsf{d}_{\top 1}$, $\mathsf{d}_{\bot 1}$, …) are sorted into *propositions* (type ωt), *worlds* (ω), *individuals* (δ), *events* (ε), *states* (σ), and *times* (τ). A $\bot\top$-list (e.g., any row in (1)–(3)) is a semantic object of type s.

DEFINITION 2 (UC types) The set of UC *types* Θ is the smallest set such that (i) $\{t, \omega, \delta, \varepsilon, \sigma, \tau\} \subseteq \Theta$, (ii) $(ab) \in \Theta$ if $a, b \in \Theta$, and (iii) $s \in \Theta$. The set of *referent types* is the subset $(\Theta|5) = \{\omega t, \omega, \delta, \varepsilon, \sigma, \tau\}$.

For each type we assume a set of variables and non-logical constants (Var_a and Con_a for all $a \in \Theta$). The syntax of UC consists of six standard rules (i–vi), four centering rules (vii–x), and three sortal rules (xi–xiii). The centering rule (vii) adds an a-object to a $\top\bot$-list. Rule (viii) builds local top-level anaphors (e.g. $\top a$ for the first a-object on the current $\top$-list). Rule (ix) builds global top-level anaphors (e.g. $\top a\{I\}$ for the entire set of $\top a$-objects on all the $\top\bot$-lists in I). Rule (x) introduces three sequencing operators: *plain* (;), *topic-comment* ($^{\top}$;), and *background-elaboration* ($^{\bot}$;). Finally, the sortal rules (xi–xiii) introduce logical temporal relations ($<$ and $\subset$) and logical operations on discourse objects.

DEFINITION 3 (UC syntax) Define for each type $a \in \Theta$ the set of a-terms as follows:

i. $Con_a \cup Var_a \subseteq Term_a$
ii. $\lambda u_a(B) \in Term_{ab}$, if $u_a \in Var_a$ and $B \in Term_b$
iii. $BA \in Term_b$, if $B \in Term_{ab}$ and $A \in Term_a$
iv. $\neg A$, $(A \to B)$, $(A \wedge B)$, $(A \vee B) \in Term_t$, if $A, B \in Term_t$
v. $\forall u_a B$, $\exists u_a B \in Term_t$, if $u_a \in Var_a$ and $B \in Term_t$
vi. $(A = B) \in Term_t$, if $A, B \in Term_a$

vii. $(u_a{}^{\top}\oplus B), (u_a{}^{\perp}\oplus B) \in Term_s$, if $a \in (\Theta|5)$, $u_a \in Var_a$, and $B \in Term_s$
viii. $\top a, \perp a \in Term_{sa}$, if $a \in (\Theta|5)$.
ix. $A\{B\} \in Term_{at}$, if $a \in (\Theta|5)$, $A \in Term_{sa}$ and $B \in Term_{st}$
x. $(A\ ;B), (A^{\top}; B), (A^{\perp}; B) \in Term_{(st)st}$, if $A, B \in Term_{(st)st}$
xi. $(A \subset B), (A < B) \in Term_t$, if $A, B \in Term_\tau$
xii. $\text{CON}\, A \in Term_\sigma$, if $A \in Term_\varepsilon$
$\text{BEG}\, A, \text{END}\, A \in Term_\varepsilon$, if $A \in Term_\sigma$
$\text{CTR}\, A, \text{DAT}\, A \in Term_\delta$, if $A \in Term_\varepsilon \cup Term_\sigma$
xiii. $\vartheta(W, A) \in Term_\tau$, if $W \in Term_\omega$ and $A \in Term_\varepsilon \cup Term_\sigma$
$\pi(W, A) \in Term_\delta$, if $W \in Term_\omega$ and $A \in Term_\varepsilon \cup Term_\sigma$

A frame for UC allows for partial functions. It also allows any object of any referent type to be added to any $\top\perp$-list. A model for UC specifies a frame and interprets non-logical constants on that frame, as usual. It also defines a possible utterance context (a pair of a *common ground*, p_0, and *speech event*, e_0) and interprets the logical symbols: < (*temporal precedence*), ϑ (*run time*), π (*place*), CON (*consequent state*), BEG (*beginning*), END (*end*), CTR (*center*) and DAT (*experiencer*). The temporal location function ϑ maps any eventuality (event or state) to its run time in every world where it is realized. Eventualities can also be located in space, by π. The run time of an event is a *discourse instant* (unit set). The consequent state (CON) begins at the next instant. The run time of a state is a *discourse period* (plural set), which begins and ends with the related changes of state (BEG, END). For any eventuality CTR and DAT specify the central individual and the experiencer, if defined. Centering is preserved by CON, BEG, and END. Finally, a verbal predicate constant centers its eventuality argument on the first individual argument. (For convenience, we write '${}^{\{\}}f$' for 'the set characterized by function f', and '${}^{\chi}A$' for 'the characteristic function of set A'.)

DEFINITION 4 (UC frames) A UC frame is a set $\{D_a|\ a \in \Theta\}$ of non-empty pairwise disjoint sets where (i) $D_t = \{1, 0\}$, D_τ is the set of non-empty convex sets of integers, (ii) $D_{ab} = \{f|\ \varnothing \subset \text{Dom}\ f \subseteq D_a \wedge \text{Ran}\ f \subseteq D_b\}$, and (iii) $D_s = \cup_{n,\, m \geq 0} \langle D\rangle^{n,\, m}$, with $D = \cup_{a \in (\Theta|5)} D_a$.

DEFINITION 5 (UC-models) A UC-model is a structure $M = \langle \{D_a|\ a \in \Theta\}, <_\tau, \mathsf{p}_0, \mathsf{e}_0, [\![\cdot]\!]\rangle$, where (i) $\{D_a|\ a \in \Theta\}$ is a UC frame (ii) for all $\mathsf{t}, \mathsf{t}' \in D_\tau$, $\mathsf{t} <_\tau \mathsf{t}'$ iff $\forall n \in \mathsf{t} \forall n' \in \mathsf{t}'$: $n < n'$, (iii) $\mathsf{p}_0 \in D_{\omega t}\backslash\{\varnothing\}$ and $\mathsf{e}_0 \in D_\varepsilon$, and (iv) $[\![\cdot]\!]$ assigns to each $A \in Con_a$ a value $[\![A]\!] \in D_a$ and to each $B \in \{\text{CON, BEG, END, CTR, DAT}, \vartheta, \pi\}$ a value $[\![B]\!]$ such that:
a. $[\![\text{CON}]\!] \in D_{\varepsilon\sigma}, [\![\text{BEG}]\!], [\![\text{END}]\!] \in D_{\sigma\varepsilon}, [\![\text{CTR}]\!], [\![\text{DAT}]\!] \in \{f_\varepsilon \cup f_\sigma|\ f_\varepsilon \in D_{\varepsilon\delta} \wedge f_\sigma \in D_{\sigma\delta}\}$
$[\![\vartheta]\!] \in \{f_\varepsilon \cup f_\sigma|\ f_\varepsilon \in D_{\omega\varepsilon\tau} \wedge f_\sigma \in D_{\omega\sigma\tau}\}, [\![\pi]\!] \in \{f_\varepsilon \cup f_\sigma|\ f_\varepsilon \in D_{\omega\varepsilon\delta} \wedge f_\sigma \in D_{\omega\sigma\delta}\}$
b. $\forall \mathsf{w} \in D_\omega, \mathsf{a} \in D_\delta, \mathsf{e} \in D_\varepsilon, \mathsf{s} \in D_\sigma, \mathsf{ev} \in D_\varepsilon \cup D_\sigma, \mathsf{t} \in D_\tau$:
$[\![\vartheta]\!](\mathsf{w}, \mathsf{e}) = \mathsf{t} \rightarrow \exists n: \mathsf{t} = \{n\} \wedge [\![\vartheta]\!](\mathsf{w}, [\![\text{BEG}]\!]([\![\text{CON}]\!](\mathsf{e}))) = \{(n + 1)\}$
$[\![\vartheta]\!](\mathsf{w}, \mathsf{s}) = \mathsf{t} \rightarrow \{\min_< \mathsf{t}\} = [\![\vartheta]\!](\mathsf{w}, [\![\text{BEG}]\!](\mathsf{s})) <_\tau [\![\vartheta]\!](\mathsf{w}, [\![\text{END}]\!](\mathsf{s})) = \{\max_< \mathsf{t}\}$
c. $[\![\text{CTR}]\!](\mathsf{ev}) = \mathsf{a} \rightarrow [\![\text{CTR}]\!]([\![B]\!](\mathsf{ev})) = \mathsf{a}$ for $B \in \{\text{CON, BEG, END}\}$
$\langle \mathsf{ev}, \mathsf{a} \ldots\rangle \in {}^{\{\}}[\![A]\!](\mathsf{w}) \rightarrow [\![\text{CTR}]\!](\mathsf{ev}) = \mathsf{a}$ for $A \in Con_{\omega\varepsilon\delta\ldots t} \cup Con_{\omega\sigma\delta\ldots t}$
d. $\exists \mathsf{t} \forall \mathsf{w} \in {}^{\{\}}\mathsf{p}_0$: $\mathsf{t} = [\![\vartheta]\!](\mathsf{w}, \mathsf{e}_0) \wedge \langle \mathsf{e}_0, [\![\text{CTR}]\!](\mathsf{e}_0)\rangle \in {}^{\{\}}[\![spk]\!](\mathsf{w})$
The pair $\langle \mathsf{p}_0, \mathsf{e}_0\rangle$ of *common ground* p_0 and *speech event* e_0 is the *utterance context* of *M*.

In the semantic definition rules (i)–(vi) are standard. The centering rule (vii) adds the value of u_a (i.e. an a-object) to the designated sub-list of the input $\top\perp$-list B. Rule (viii) says that a local anaphor $\top a$ (or $\perp a$) refers to the top-ranked a-object on the $\top$-list ($\perp$-list), if there is such an object; otherwise it fails to refer. Rule (ix) says that a global anaphor $A\{B\}$ refers to the *global* *value* of A in state B, i.e. the set of all A-objects on the $\top\bot$-lists of B. Rule (x) interprets a plain sequence $(A; B)$ as function composition: the input state is updated with A and the result, with B. A topic-comment sequence $(A^{\top}; B)$ reduces to plain sequencing, $(A; B)$, if A updates each $\top$-list of the input state with at least one discourse object and the top-ranked A-topic is referred to by a suitable anaphor $\top a$ and maintains its top a-rank in B. A background-elaboration sequence $(A^{\bot}; B)$ is defined analogously for $\bot$-list update and top-level anaphora to $\bot$-lists. The sortal rules (xi)–(xiii) interpret the temporal relation symbols ($\subset$ and $<$) as temporal orders (proper subset $\subset$ and τ-precedence $<_\tau$), and the logical operators on discourse objects as specified by the model.

ABBREVIATIONS (Projections and extensions)

i.	$(x)_n$	$=$	the nth coordinate, x_n	for $x \in D^{n+m}$, $n \geq 1$
	$(x)_a$	$=$	the subsequence consisting of $x_i \in D_a$	for $x \in D^n$, $a \in \Theta$
ii.	$(d \oplus x)$	$=$	$\langle d, x_1, \dots, x_n\rangle$	for $d \in D$, $x \in D^n$
	$y > x$	iff	$y = (y_1 \oplus \dots (y_n \oplus x))$	for $x \in D^n$, $y \in D^{n+m}$
	$y \geq x$	iff	$y > x \vee y = x$	for $x \in D^n$, $y \in D^m$

DEFINITION 6 (UC semantics). The value $\llbracket A \rrbracket^g$ of a term A given $\llbracket \cdot \rrbracket$ and an assignment g is defined as follows (we write '$X \doteq Y$' for 'X is Y, if Y is defined, else X is undefined', '$X[Y/Z]$' for the result of replacing every occurrence of Y in X with Z, '$c\llbracket X \rrbracket^g$' for '$\llbracket X \rrbracket^g(c)$', and use the Von Neumann definition so $0 = \varnothing$ and $1 = \{\varnothing\}$):

i.	$\llbracket A \rrbracket^g$	$=$	$\llbracket A \rrbracket$	for any $A \in Con_a$
	$\llbracket u \rrbracket^g$	$=$	$g(u)$	for any $u \in Var_a$
ii.	$\llbracket \lambda u_a(B) \rrbracket^g(d)$	$\doteq$	$\llbracket B \rrbracket^{g[u/d]}$	for any $d \in D_a$
iii.	$\llbracket BA \rrbracket^g$	$\doteq$	$\llbracket B \rrbracket^g(\llbracket A \rrbracket^g)$	
iv.	$\llbracket \neg A \rrbracket^g$	$\doteq$	$1 \backslash \llbracket A \rrbracket^g$	
	$\llbracket (A \rightarrow B) \rrbracket^g$	$\doteq$	$1 \backslash (\llbracket A \rrbracket^g \backslash \llbracket B \rrbracket^g)$	
	$\llbracket (A \wedge B) \rrbracket^g$	$\doteq$	$\llbracket A \rrbracket^g \cap \llbracket B \rrbracket^g$	
	$\llbracket (A \vee B) \rrbracket^g$	$\doteq$	$\llbracket A \rrbracket^g \cup \llbracket B \rrbracket^g$	
v.	$\llbracket \forall u_a A \rrbracket^g$	$\doteq$	$\bigcap_{d \in D_a} \llbracket A \rrbracket^{g[u/d]}$	
	$\llbracket \exists u_a A \rrbracket^g$	$\doteq$	$\bigcup_{d \in D_a} \llbracket A \rrbracket^{g[u/d]}$	
vi.	$\llbracket A_a = B_a \rrbracket^g$	$=$	$\lvert\{\langle d, d'\rangle \in D_a^2 \mid d = \llbracket A \rrbracket^g \wedge d' = \llbracket B \rrbracket^g \wedge d = d'\}\rvert$	
vii.	$\llbracket u_a\, {}^{\top}\!\oplus B \rrbracket^g$	$\doteq$	$\langle (g(u_a) \oplus \top\llbracket B \rrbracket^g), \bot\llbracket B \rrbracket^g\rangle$	
	$\llbracket u_a\, {}^{\bot}\!\oplus B \rrbracket^g$	$\doteq$	$\langle \top\llbracket B \rrbracket^g, (g(u_a) \oplus \bot\llbracket B \rrbracket^g)\rangle$	
viii.	$\llbracket \top a \rrbracket^g(i)$	$\doteq$	$((\top i)_a)_1$	for any $i \in D_s$
	$\llbracket \bot a \rrbracket^g(i)$	$\doteq$	$((\bot i)_a)_1$	for any $i \in D_s$
ix.	$\llbracket A\{B\} \rrbracket^g$	$\doteq$	${}^{\chi}\{\llbracket A \rrbracket^g(i) \mid i \in {}^{\{\}}\llbracket B \rrbracket^g\}$	
x.	$c\llbracket A; B \rrbracket^g$	$\doteq$	$c\llbracket A \rrbracket^g \llbracket B \rrbracket^g$	for any $c \in D_{st}$
	$c\llbracket A^{\top}; B \rrbracket^g$	$\doteq$	$\{l \in c\llbracket A; B \rrbracket^g \mid \exists a \forall k \in c\llbracket A; B \rrbracket^g \exists j \in c\llbracket A \rrbracket^g \exists i \in c \exists d \in D_a$: $\top k \geq \top j > \top i \wedge (\top j)_1 = d \wedge \llbracket B \rrbracket^g \neq \llbracket B[\top a/\bot a] \rrbracket^g \wedge \llbracket \top a \rrbracket(k) = d\}$	
	$c\llbracket A^{\bot}; B \rrbracket^g$	$\doteq$	$\{l \in c\llbracket A; B \rrbracket^g \mid \exists a \forall k \in c\llbracket A; B \rrbracket^g \exists j \in c\llbracket A \rrbracket^g \exists i \in c \exists d \in D_a$: $\bot k \geq \bot j > \bot i \wedge (\bot j)_1 = d \wedge \llbracket B \rrbracket^g \neq \llbracket B[\bot a/\top a] \rrbracket^g \wedge \llbracket \bot a \rrbracket(k) = d\}$	
xi.	$\llbracket A \subset B \rrbracket^g$	$=$	$\lvert\{\langle t, t'\rangle \in D_\tau^2 \mid t = \llbracket A \rrbracket^g \wedge t' = \llbracket B \rrbracket^g \wedge t \subset t'\}\rvert$	
	$\llbracket A < B \rrbracket^g$	$=$	$\lvert\{\langle t, t'\rangle \in D_\tau^2 \mid t = \llbracket A \rrbracket^g \wedge t' = \llbracket B \rrbracket^g \wedge t <_\tau t'\}\rvert$	
xii.	$\llbracket BA \rrbracket^g$	$\doteq$	$\llbracket B \rrbracket(\llbracket A \rrbracket^g)$	
xiii.	$\llbracket B(W, A) \rrbracket^g$	$\doteq$	$\llbracket B \rrbracket(\llbracket W \rrbracket^g, \llbracket A \rrbracket^g)$	

In the linguistic analyses that follow we abbreviate UC types and variables as in Table 1 and abbreviate UC translations using the drt-style abbreviations defined and exemplified in Table 2. Abbreviations are easier to read and can always be spelled out as proper UC terms that can be interpreted by the semantic rules of UC (see (4) and its interpretation (5)–(10)).

Table 1 (UC variables)

$a \in \Theta$	Abbreviation	Var_a	Name of objects
i. δ		x, y	(ordinary) individuals
ε		e	events
σ		s	states (of individuals)
τ		t	times
ω		w, v	worlds
ωt	$=: \ \Omega$	p, q	propositions
ii. s		i, j	$\top\bot$-lists
st		I, J	infotention states
$(st)st$	$=: \ [\ ]$	K	updates
iii. $s\delta$	$=: \ \mathrm{D}$	$\underline{x}, \underline{y}$	δ-projections
$s\varepsilon$	$=: \ \mathrm{E}$	$\underline{e}$	ε-projections
$s\sigma$	$=: \ \mathrm{S}$	$\underline{s}$	σ-projections
$s\tau$	$=: \ \mathrm{T}$	$\underline{t}$	τ-projections
$s\omega$	$=: \ \mathrm{W}$	$\underline{w}$	ω-projections
$a_1 \ldots (a_n[])$	$=: \ [a_1 \ldots a_n]$		

Table 2 (drt notation)

Abbreviation		UC term	Example
i. Static terms			
$(A \leq B)$	:=	$(A = B \vee A < B)$	$(t_1 \leq t_2)$
$(A \subseteq B)$	:=	$(A = B \vee A \subset B)$	$(t_1 \subseteq t_2)$
$(A_a \in B_{at})$	:=	BA	$(w \in p)$
$\mathrm{AT}(w, e, t)$	:=	$(\vartheta_w\, e \subset t)$	
$\mathrm{AT}(w, s, t)$	:=	$(t \subset \vartheta_w\, s)$	
$\mathrm{EVT}\ s$	:=	$\mathrm{BEG}\ s$	
$\mathrm{EVT}\ e$	:=	e	
$\mathrm{STA}\ e$	:=	$\mathrm{CON}\ e$	
$\mathrm{STA}\ s$	:=	s	
ii. Local projections | conditions ($a \in (\Theta|5)$, $\mathbf{R} \in \{=, \neq, \in, \subseteq, \subset, \leq, <\}$)			
$A_a{}^{\circ}$	:=	$\lambda i.\ A$	jim°, x°
$A_{sa}{}^{\circ}$	:=	A	$\bot\varepsilon^{\circ}, \underline{x}^{\circ}$
$(B_{ab}\, A_{sa})^{\circ}$	:=	$\lambda i.\ B\, A^{\circ}i$	$(\mathrm{CTR}\ \top\varepsilon)^{\circ}$
$(B_W\, A)^{\circ}$	:=	$\lambda i.\ B(W^{\circ}i, A^{\circ}i)$	$(\vartheta_{\top\omega}\top\varepsilon)^{\circ}$
$B_W\langle A_1, \ldots A_n\rangle$	:=	$\lambda i.\ B(W^{\circ}i, A_1{}^{\circ}i, \ldots\ A_n{}^{\circ}i)$	$sad_{\top\omega}\langle s, \mathrm{CTR}\ s\rangle$
$(A\ \mathbf{R}_i\ B)$	:=	$\lambda i.\ A^{\circ}i\ \mathbf{R}\ B^{\circ}i$	$(\top\delta =_i jim)$
$(A\ \mathbf{R}_W\ B)$	:=	$\lambda i.\ \vartheta_{W^{\circ}i}\, A^{\circ}i\ \mathbf{R}\ \vartheta_{W^{\circ}i}\, B^{\circ}i$	$(\bot\varepsilon <_{\top\omega} \top\varepsilon)$
(C_1, C_2)	:=	$\lambda i.\ C_1 i \wedge C_2 i$	
iii. Local drt-boxes			
$[C]$	:=	$\lambda I\lambda j.\ Ij \wedge Cj$	$[\top\delta =_i jim]$
$[u]$	:=	$\lambda I\lambda j.\ \exists u\exists i(j = (u\ {}^{\bot}\!\oplus\ i) \wedge Ii)$	$[y]$
${}^{\top}[u]$	:=	$\lambda I\lambda j.\ \exists u\exists i(j = (u\ {}^{\top}\!\oplus\ i) \wedge Ii)$	${}^{\top}[x]$

$[u_1\ldots u_n|\ C]$:= $\lambda I\lambda j.\ \exists u_1\ldots u_n\exists i(j = (u_1\ {}^{\perp}\!\oplus \ldots (u_n\ {}^{\perp}\!\oplus\ i)) \wedge Ii \wedge Ci)$ $[y|\ y =_i jim]$

${}^{\top}[u_1\ldots u_n|\ C]$:= $\lambda I\lambda j.\ \exists u_1\ldots u_n\exists i(j = (u_1\ {}^{\top}\!\oplus \ldots (u_n\ {}^{\top}\!\oplus\ i)) \wedge Ii \wedge Ci)$ ${}^{\top}[x|\ x =_i jim]$

iv. Global drt-boxes ($\mathbf{R} \in \{=, \neq, \in, \subseteq, \subset\}$)

$[B\,\mathbf{R}\,A||]$:= $\lambda I\lambda j.\ Ij \wedge Bj\ \mathbf{R}\ A\{I\})$ $[\perp\omega \in\ \top\omega||]$

$[u|\ u\,\mathbf{R}\,A||]$:= $\lambda I\lambda j.\ \exists u\exists i(j = (u\ {}^{\perp}\!\oplus\ i) \wedge Ii \wedge u\ \mathbf{R}\ A\{I\})$ $[p|\ p = \top\omega||]$

${}^{\top}[u|\ u\,\mathbf{R}\,A||]$:= $\lambda I\lambda j.\ \exists u\exists i(j = (u\ {}^{\top}\!\oplus\ i) \wedge Ii \wedge u\ \mathbf{R}\ A\{I\})$ ${}^{\top}[p|\ p = \top\omega||]$

$[B_W\{A_1,\ldots A_n||\}]$:= $\lambda I\lambda j.\ Ij \wedge B\ W^{\circ}j\ A_1{}^{\circ}j\ \ldots\ A_n\{I\}$

$[\mathrm{AT}_W\{A, T\}]$:= $\lambda I\lambda j.\ Ij \wedge (\exists i(Ii \wedge \vartheta_{Wi}\ \mathrm{EVT}\ Ai \subset Ti) \rightarrow \vartheta_{Wj}\ \mathrm{EVT}\ Aj \subset Tj)$
$\wedge (\neg\exists i(Ii \wedge \vartheta_{Wi}\ \mathrm{EVT}\ Ai \subset Ti) \rightarrow Tj \subset \vartheta_{Wj}\ \mathrm{STA}\ Aj)$

${}^{\mathrm{P}}K$:= $\lambda I\lambda j.\ KIj \wedge \forall w(w \in\ \top\omega\{I\} \rightarrow w \in\ \top\omega\{KI\})$ ${}^{\mathrm{P}}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau]$

Boxes are interpreted relative to the utterance context of the model, i.e. an initial common ground ($\mathrm{p}_0 \neq \varnothing$) and a speech act ($\mathrm{e}_0$) that takes place at a particular time throughout this modal domain (see D5). Speaking up focuses attention on the speech act and thereby introduces default modal and temporal topics ($(\cdot)^{\top}$ in the model below). The resulting *default state* of infotention formally represents Stalnaker's 'commonplace effect':

DEFINITION 7 (UC default state) Given a UC model with an utterance context $\langle \mathrm{p}_0, \mathrm{e}_0\rangle$, we define the *default infotention state* $*\langle \mathrm{p}_0, \mathrm{e}_0\rangle := {}^{\chi}\{\langle\langle \mathrm{t}, \mathrm{w}, \mathrm{p}_0, \mathrm{e}_0\rangle, \langle\ \rangle\rangle|\ \mathrm{w} \in {}^{\{\}}\mathrm{p}_0 \wedge \mathrm{t} = [\![\vartheta]\!](\mathrm{w}, \mathrm{e}_0)\}$

${}^{\top}\mathrm{w}_0 \in {}^{\top}\mathrm{p}_0$ • ${}^{\top}\mathrm{e}_0$: e_0−ctr speaks up
| ${}^{\top}\mathrm{t}_0 = [\![\vartheta]\!](\mathrm{w}_0, \mathrm{e}_0)$: e_0-instant

The default state is then updated with the content of what is said—Stalnaker's 'essential effect'). For instance, if the speaker says *Jim is busy* then this state is updated with (4a).

(4) a. ${}^{\top}[x|\ x =_i jim]\ {}^{\top}$; $({}^{\mathrm{P}}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau]$; $[\top\omega \in\ \top\omega||]$; $([s|\ busy_{\top\omega}\langle s, \mathrm{CTR}\ s\rangle]\ {}^{\perp}$; $[\mathrm{AT}_{\top\omega}\langle\perp\sigma,$ $\top\tau\rangle, \mathrm{CTR}\ \perp\sigma =_i \top\delta]))$; ${}^{\top}[p|\ p = \top\omega||]$

b. ${}^{\top}[x|\ x =_i jim]$; ${}^{\mathrm{P}}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau]$; $[s|\ busy_{\top\omega}\langle s, \top\delta\rangle, \top\tau \subset_i \vartheta_{\top\omega}\ s]$; ${}^{\top}[p|\ p = \top\omega||]$

This sequence of updates is equivalent to (4b), as we now proceed to show. We first note that both ${}^{\top}$; and ${}^{\perp}$; reduce to plain sequencing ;. The topic-box of ${}^{\top}$; puts Jim on top of the $\top$-list, and this individual is referred to and maintains its $\top\delta$-rank in the comment. Similarly, the background box of ${}^{\perp}$; puts a state on top of the $\perp$-list, and this state is referred to and maintains its $\perp\sigma$-rank in the elaboration. So (4a) reduces to a plain sequence which updates the default state $*\langle \mathrm{p}_0, \mathrm{e}_0\rangle$ with each box in turn.

The first box represents the subject, which introduces its referent as a topical individual (see (5)). The output common ground (set of topic worlds) is still ${}^{\{\}}\mathrm{p}_0$ and the topic time is still the speech instant. The temporal presupposition of the non-past tense is therefore satisfied (see (6)).

(5) $*\langle \mathrm{p}_0, \mathrm{e}_0\rangle[\![{}^{\top}[x|\ x =_i jim]]\!]^g$ $=: \mathrm{c}_1$
$:=\ [\![{}^{\mathrm{P}}(\lambda I\lambda j.\ \exists x\exists i(j = (x\ {}^{\top}\!\oplus\ i) \wedge Ii \wedge x = jim))]\!]^g(*\langle \mathrm{p}_0, \mathrm{e}_0\rangle)$
$=\ {}^{\chi}\{\langle\langle \mathrm{a}, \mathrm{t}, \mathrm{w}, \mathrm{p}_0, \mathrm{e}_0\rangle, \langle\ \rangle\rangle|\ \mathrm{w} \in {}^{\{\}}\mathrm{p}_0 \wedge \mathrm{t} = [\![\vartheta]\!](\mathrm{w}, \mathrm{e}_0) \wedge \mathrm{a} = [\![jim]\!]\}$

(6) $\mathrm{c}_1[\![{}^{\mathrm{P}}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau]]\!]^g$
$:=\ [\![{}^{\mathrm{P}}(\lambda I\lambda j.\ Ij \wedge \vartheta_{\top\omega j}\ \top\varepsilon j \leq \top\tau j)]\!]^g(\mathrm{c}_1)$
$=\ {}^{\chi}\{\langle\langle \mathrm{a}, \mathrm{t}, \mathrm{w}, \mathrm{p}_0, \mathrm{e}_0\rangle, \langle\ \rangle\rangle \in \mathrm{c}_1|\ \forall \mathrm{v} \in {}^{\{\}}\mathrm{p}_0\colon [\![\vartheta]\!](\mathrm{v}, \mathrm{e}_0) = \mathrm{t} \vee \ldots\}$ $= \mathrm{c}_1$

The modal assertion, that the world of evaluation is in the common ground, is trivially true in root clauses, where the evaluation world is the topic world (see (7)).

(7) $c_1[\![[\top\omega \in \top\omega\|]]\!]^g$
$:= [\![\lambda I\lambda j.\ Ij \wedge \top\omega j \in \top\omega\{I\}]\!]^g(c_1)$
$= {}^{\chi}\{\langle\langle a, t, w, p_0, e_0\rangle, \langle\,\rangle\rangle \in c_1 |\ w \in {}^{\{\}}p_0\}$ $= c_1$

The verbal predicate be- busy adds a busy state (8). The non-past tense locates this state in the topic world at the topic time and identifies its center with the topical individual (9). Finally, the set of surviving topic worlds is introduced as a topical proposition (10).

(8) $c_1[\![[s|\ busy_{\top\omega}\langle s, \text{CTR } s\rangle]]\!]^g$ $=: c_2$
$:= [\![\lambda I\lambda j.\ \exists s\exists i(j = (s \,{}^{\perp}\!\oplus i) \wedge Ii \wedge busy(\top\omega i, s, \text{CTR } s))]\!]^g(c_1)$
$= {}^{\chi}\{\langle\langle a, t, w, p_0, e_0\rangle, \langle s\rangle\rangle |\ \langle\langle a, t, w, p_0, e_0\rangle, \langle\,\rangle\rangle \in c_1$
$\wedge \langle s, [\![\text{CTR}]\!](s)\rangle \in {}^{\{\}}[\![busy]\!](w)\}$

(9) $c_2[\![[\text{AT}_{\top\omega}\langle\perp\sigma, \top\tau\rangle, \text{CTR } \perp\sigma =_i \top\delta]]\!]^g$ $=: c_3$
$:= [\![\lambda I\lambda j(Ij \wedge \top\tau j \subset \vartheta_{\top\omega j} \perp\sigma j \wedge \text{CTR } \perp\sigma j = \top\delta j)]\!]^g(c_2)$
$= {}^{\chi}\{\langle\langle a, t, w, p_0, e_0\rangle, \langle s\rangle\rangle \in c_2 |\ t \subset [\![\vartheta]\!](w, s) \wedge [\![\text{CTR}]\!](s) = a\}$
$= {}^{\chi}\{\langle\langle a, t, w, p_0, e_0\rangle, \langle s\rangle\rangle |\ w \in {}^{\{\}}p_0 \wedge t = [\![\vartheta]\!](w, e_0) \wedge a = [\![jim]\!]$
$\wedge \langle s, a\rangle \in {}^{\{\}}[\![busy]\!](w) \wedge t \subset [\![\vartheta]\!](w, s)\}$ (by D5)

(10) $c_3[\![{}^{\top}[p|\ p = \top\omega\|]]\!]^g$ $=: c_4$
$:= [\![\lambda I\lambda j\ \exists p\exists i(j = (p\,{}^{\top}\!\oplus i) \wedge Ii \wedge p = \top\omega\{I\})]\!]^g(c_3)$
$= {}^{\chi}\{\langle\langle p_1, a, t, w, p_0, e_0\rangle, \langle s\rangle\rangle |\ w \in {}^{\{\}}p_0 \wedge t = [\![\vartheta]\!](w, e_0)$
$\wedge a = [\![jim]\!] \wedge \langle s, a\rangle \in {}^{\{\}}[\![busy]\!](w) \wedge t \subset [\![\vartheta]\!](w, s)$
$\wedge p_1 = {}^{\chi}\{v \in {}^{\{\}}p_0 |\ \exists s'\text{: } \langle s', a\rangle \in {}^{\{\}}[\![busy]\!](v) \wedge [\![\vartheta]\!](v, e_0) \subset [\![\vartheta]\!](v, s')\}\}$

An (*st*)*st*-term K has a truth value just in case it introduces a proposition as the primary topic. K is then true just in case the topical proposition is true.

DEFINITION 8 (Truth values) Given a state c, an (*st*)*st* term K adds the set of *primary topics* $\top_c K = \{(\top j)_1 |\ \forall g\text{: } j \in {}^{\{\}}(c[\![K]\!]^g) \wedge j \notin {}^{\{\}}c\}$. The term K has a truth value iff either (i) or (ii):

i. K is *true* in c at w iff $\exists p \in D_\Omega\text{: } \top_c K = \{p\} \wedge w \in {}^{\{\}}p$,
ii. K is *false* in c at w iff $\exists p \in D_\Omega\text{: } \top_c K = \{p\} \wedge w \notin {}^{\{\}}p$.

The (*st*)*st*-term (4a) updates the default state $*\langle p_0, e_0\rangle$ to (10). Since the primary topic of (10) is a proposition (${}^{\top}p_1$), (4a) (and the equivalent (4b)) is true in the following model.

${}^{\top}w_0 \in {}^{\top}p_1$	•	${}^{\top}e_0$: e_0–ctr speaks, updates CG to ${}^{\top}p_1 \subseteq {}^{(\top)}p_0$
	|	${}^{\top}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
	————	s_1: Jim is busy (at ${}^{\top}t_0$)

In what follows we combine UC with the compositional rules of CCG to develop a theory of temporal and modal reference that generalizes across English and Kalaallisut.

3. Centering theory of English tense

According to a well-established theory, English tenses are temporal anaphors parallel to anaphoric pronouns (Partee 1973, Webber 1988, a.o.). A past, non-past, or future tense presupposes that the topic time is past, non-past, or future relative to the speech act (see (11)–(14), Reichenbach 1947, Klein 1994, Stone 1997). The topic time includes the verbal eventuality if it is an event (e.g. *leave*), and is included within it if it is a state (e.g. *have left* or *be sad*, see Kamp 1979, Partee 1984, Moens and Steedman 1988). Finally, an event verb may advance the topic time to the consequent state (as in (13) and (14), see Webber 1988).

(11)	i. *Jim has left.*	ii.	*I am sad.*		NPST – NPST
(12)	i. *Jim left today.*	ii.	*Sue was asleep.*		PST – PST
(13)	i. *Jim leaves today.*	ii.	*Sue will be sad.*		NPST – FUT
(14)	*If Jim leaves Sue will be sad.*				NPST – FUT

I propose to implement this standard anaphoric theory of tense in CCG (Steedman 2000 a.o.) with UC as the semantic representation language. To analyze the fragment of English exemplified in (11)–(14) I propose four basic categories: sentence (s), sentence radical ($\underline{\mathrm{s}}$), pronoun (pn), and adjective phrase (ap).

E1 (Categories for English)
i. s, $\underline{\mathrm{s}}$, pn, and ap are English categories;
ii. If X and Y are English categories, then so are X/Y and $X\backslash Y$.
ABBREVIATION: iv := $\underline{\mathrm{s}}\backslash$pn (intransitive)

In categorial grammars the syntactic category determines the semantic type. The category-to-type rule is given in E2 (using type abbreviations from Table 1). Sentences (s) denote updates (type [ ]); radicals ($\underline{\mathrm{s}}$) denote dynamic propositions ([W]); pronouns (pn), individual-valued projections (D); and adjectives (ap), dynamic properties of states ([SW]). Functor categories, X/Y or $X\backslash Y$, send arguments of type $\mathbf{tp}(Y)$ to values of type $\mathbf{tp}(X)$.

E2 (English category-to-type rule)
i. $\mathbf{tp}(\mathrm{s}) = [\ ]$, $\mathbf{tp}(\underline{\mathrm{s}}) = [\mathrm{W}]$, $\mathbf{tp}(\mathrm{pn}) = \mathrm{D}$, $\mathbf{tp}(\mathrm{ap}) = [\mathrm{SW}]$
ii. $\mathbf{tp}(X/Y) = \mathbf{tp}(X\backslash Y) = \mathbf{tp}(Y)\mathbf{tp}(X)$

Table 3 lays out the categories and types for the English items in (10)–(13). In what follows *jim*, *tod*, *sad*, and *leave* are constants of type δ, $\omega\varepsilon\delta$, $\omega\sigma\delta t$, and $\omega\varepsilon\delta t$. Strings of types associate to the right, e.g. $\omega\sigma\delta t$ abbreviates $\omega(\sigma(\delta t))$. In contrast, sequencing operators associate to the left, e.g. $K_1; K_2{}^{\top}; K_3{}^{\perp}; K_4$ abbreviates $((K_1; K_2)^{\top}; K_3)^{\perp}; K_4$.

Table 3

English item	*Category*	*UC type a*	$u \in {}^{\perp}Var_a$
leave-	$\underline{s}$	[W]	$\underline{V}$
have-	$\underline{s}/\underline{s}_{pp}$	[W][W]	
be-	$\underline{s}$/ap	[SW][W]	
sad, *asleep*, *busy*	ap	[SW]	$\underline{A}$
-PP, -INF	$\underline{s}_{pp}\backslash\underline{s}$, $\underline{s}_{inf}\backslash\underline{s}$	[W][W]	
-PST, -NPST	iv\\$\underline{s}$	[W][DW]	
WILL	iv/$\underline{s}_{inf}$	[W][DW]	
I, *you*, *he*	pn	D	$\underline{x}$
$Jim^{\top}$	$\underline{s}$/iv	[DW][W]	
today	iv\iv	[DW][DW]	
. (declarative prosody)	s\\$\underline{s}$	[W][ ]	

In English most verbal roots are event-radicals, like *leave-*. The perfect auxiliary *have-* derives a state-radical by adding the consequent state of the root event (see Moens and Steedman 1988). The copula *be-* turns an adjective into a state-radical. The subject argument ($\underline{x}$) is not represented in the root; in finite clauses it is added by tense (cf. Kratzer 1996). Non-finite inflections (e.g. -PP, -INF) add syntactic features but no semantic content.

leave- $\underline{s}$: $\lambda\underline{w}.\ [e|\ leave_{\underline{w}}\langle e, \text{CTR } e\rangle]$
have- $\underline{s}/\underline{s}_{pp}$: $\lambda\underline{V}\lambda\underline{w}.\ \underline{V}\ \underline{w}\ {}^{\perp}; [s|\ s =_i \text{CON EVT} \perp a]$
be- $\underline{s}$/ap: $\lambda\underline{A}\lambda\underline{w}.\ [s]\ {}^{\perp}; \underline{A} \perp\sigma\ \underline{w}$
sad ap: $\lambda\underline{s}\lambda\underline{w}.\ [sad_{\underline{w}}\langle\underline{s}, \text{CTR } \underline{s}\rangle]$
-PP $\underline{s}_{pp}\backslash\underline{s}$: $\lambda\underline{V}.\ \underline{V}$
-INF $\underline{s}_{inf}\backslash\underline{s}$: $\lambda\underline{V}.\ \underline{V}$

A radical combines with tense into a tensed iv. I define tense as a grammatical marker with a presupposition (^{P}) that locates the topic time ($\top\tau$) relative to the perspective point (by default, the speech act $\top\varepsilon$). Like all grammatical markers, tenses form a paradigm such that exactly one member of the paradigm is required in certain grammatical constructions (e.g. finite clauses). The English tense paradigm includes two *pure tense* inflections (past -PST and non-past -NPST) and a set of *modal tense* auxiliaries (e.g. vivid future WILL). Modal tenses carry an additional modal presupposition, which relates the evaluation world ($\underline{w}$) to the common ground ($\top\omega||$, cf. Stone 1997). All tenses, be they pure or modal, locate the $\underline{s}$-eventuality in the evaluation world at the topic time ($\text{AT}_{\underline{w}}\langle\perp a, \top\tau\rangle$, with $a \in \{\varepsilon, \sigma\}$) (see Reichenbach 1947, Kamp and Reyle 1993) and center it on the subject (cf. Kratzer 1996).

-PST iv\\$\underline{s}$: $\lambda\underline{V}\lambda\underline{x}\lambda\underline{w}.\ {}^{P}[\top\tau <_i \vartheta_{\top\omega}\top\varepsilon]; \underline{V}\ \underline{w}\ {}^{\perp}; [\text{AT}_{\underline{w}}\langle\perp a, \top\tau\rangle, \text{CTR} \perp a =_i \underline{x}]$
-NPST iv\\$\underline{s}$: $\lambda\underline{V}\lambda\underline{x}\lambda\underline{w}.\ {}^{P}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau]; [\underline{w} \in \top\omega||]; \underline{V}\ \underline{w}\ {}^{\perp}; [\text{AT}_{\underline{w}}\langle\perp a, \top\tau\rangle, \text{CTR} \perp a =_i \underline{x}]$
WILL iv/$\underline{s}_{inf}$: $\lambda\underline{V}\lambda\underline{x}\lambda\underline{w}.\ {}^{P}[\vartheta_{\top\omega}\top\varepsilon <_i \top\tau]; {}^{P}[\underline{w} \in \top\omega||]; \underline{V}\ \underline{w}\ {}^{\perp}; [\text{AT}_{\underline{w}}\langle\perp a, \top\tau\rangle, \text{CTR} \perp a =_i \underline{x}]$

Tense may also accommodate and/or update the topic time, via two lexical operations: $^{\top}(\cdot)$- or -$(\cdot)^{\top}$. The latter can only apply to a tensed *event* iv, since it updates the topic time to a subinterval of the consequent state of that event (adapting Kamp 1979, Webber 1988).

-$^{\top}(\cdot)$ iv/iv: $\lambda\underline{P}\lambda\underline{x}\lambda\underline{w}.\ {}^{\top}[t]\ {}^{\top}; \underline{P}\ \underline{x}\ \underline{w}$ (topic time accommodation)
-$(\cdot)^{\top}$ iv\iv: $\lambda\underline{P}\lambda\underline{x}\lambda\underline{w}.\ \underline{P}\ \underline{x}\ \underline{w}\ {}^{\perp}; {}^{\top}[t|\ t \subseteq_i \vartheta_{\underline{w}} \text{ CON} \perp\varepsilon]$ (topic time update)

A tensed iv combines with the nominal subject into a radical ($\underline{s}$). Personal pronouns (pn) refer to the speaker (*I*), addressee (*you*), or some other salient individual (*he*).

I	pn: $(\text{CTR} \top \varepsilon)^{\text{o}}$	*he*	pn: $\top\delta$
you	pn: $(\text{DAT} \top \varepsilon)^{\text{o}}$		pn: $\bot\delta$

A non-pronominal subject (e.g. *Jim*$^{\top}$) sets up its referent as a topic and predicates the tensed iv of that topic. Noun phrases may also serve as objects or iv-modifiers (e.g. *today*).

Jim$^{\top}$ $\underline{s}$/iv: $\lambda\underline{P}\lambda\underline{w}.\ ^{\top}[x|\ x =_i jim]^{\top};\ \underline{P}\ \top\delta\ \underline{w}$

today iv\iv: $\lambda\underline{P}\lambda\underline{x}\lambda\underline{w}.\ \underline{P}\ \underline{x}\ \underline{w}^{\bot};\ [\vartheta_{\underline{w}}\ \bot a \subseteq_i tod_{\top\omega}\top\varepsilon]$ $\quad a \in \{\varepsilon, \sigma\}$

In English illocutionary force is in part marked by prosody, e.g. the full stop prosody turns a radical into a declarative sentence by predicating the radical of the topic world and introducing the set of surviving topic worlds as the primary topic of the output sentence:

. s\\$\underline{s}$: $\lambda\underline{V}.\ \underline{V}\ \top\omega;\ ^{\top}[p|\ p = \top\omega||]$

In CCG language-specific items are combined by universal combinatory rules, which build and directly interpret complex expressions. For us, the relevant rules are application and composition (see Steedman 2000).

- $X/Y: B_{ab}$ $\quad Y: A_a$ $\quad \Rightarrow_{>}$ $\quad X: BA$ (*application*)
  $Y: A_a$ $\quad X\backslash Y: B_{ab}$ $\quad \Rightarrow_{<}$ $\quad X: BA$
- $X/Y: B_{bc}$ $\quad Y/Z: A_{ab}$ $\quad \Rightarrow_{>\mathbf{B}}$ $\quad X/Z: \lambda u_a.\ B(Au)$ (*harmonic composition*)
  $Y\backslash Z: A_{ab}$ $\quad X\backslash Y: B_{bc}$ $\quad \Rightarrow_{<\mathbf{B}}$ $\quad X\backslash Z: \lambda u_a.\ B(Au)$
- $Y/Z: A_{ab}$ $\quad X\backslash Y: B_{bc}$ $\quad \Rightarrow_{<\mathbf{B}\times}$ $\quad X/Z: \lambda u_a.\ B(Au)$ (*crossed composition*)

I assume that these rules build both interpreted words (e.g. *has*) and sentences (e.g. (11i)). (15a) and (16a) reduce to (15b) and (16b). On this analysis (11i) introduces a consequent state (s_1) of Jim's departure (e_1). (11ii) adds a sad state (s_2) of the speaker. Both states hold in the topic world at the non-past topic time (speech instant). Also, after each sentence, prosody (**.**) updates the common ground to the set of surviving topic worlds.

(15) a. *have-* -NPST = *has*

$\underline{s}/\underline{s}_{\text{pp}}$ $\quad$ iv\\$\underline{s}$

———— $<\mathbf{B}_{\times}$

iv/$\underline{s}_{\text{pp}}$: $\lambda\underline{V}\lambda\underline{x}\lambda\underline{w}.\ ^{\text{P}}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau];\ [\underline{w} \in \top\omega||];\ \underline{V}\ \underline{w}^{\bot};\ [s|\ s =_i \text{CON EVT}\ \bot\varepsilon]^{\bot};$
$[\text{AT}_{\underline{w}}\langle\bot\sigma, \top\tau\rangle, \text{CTR}\ \bot\sigma =_i \underline{x}]$

b. iv/$\underline{s}_{\text{pp}}$: $\lambda\underline{V}\lambda\underline{x}\lambda\underline{w}.\ ^{\text{P}}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau];\ [\underline{w} \in \top\omega||];\ \underline{V}\ \underline{w}^{\bot};\ [s|\ s =_i \text{CON}\ \bot\varepsilon,\ \top\tau \subset_i \vartheta_{\underline{w}}\ s,$
$\text{CTR}\ s =_i \underline{x}]$

(16) a. *Jim*$^{\top}$ *have*-NPST *leave*-PP **.** = (11i)

Jim$^{\top}$	*have*-NPST	*leave*-PP	.
$\underline{s}$/iv	iv/$\underline{s}_{pp}$	$\underline{s}_{pp}$	s\\$\underline{s}$
	———————— >		
———————————— <			
——————————————— <			

s: $^{\top}[x|\ x =_i jim]^{\top};\ (^{P}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau];\ [\top\omega \in\ \top\omega||];\ [e|\ leave_{\top\omega}\langle e, \text{CTR}\ e\rangle]^{\bot};$
$[s|\ s =_i \text{CON}\ \bot\varepsilon,\ \top\tau \subset_i \vartheta_{\top\omega}\ s,\ \text{CTR}\ s =_i \top\delta]);\ ^{\top}[p|\ p = \top\omega||]$

b. s: $^{\top}[x|\ x =_i jim];\ ^{P}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau];\ [s\ e|\ leave_{\top\omega}\langle e, \top\delta\rangle,\ s =_i \text{CON}\ e,\ \top\tau \subset_i \vartheta_{\top\omega}\ s];$
$^{\top}[p|\ p = \top\omega||]$

(17) *I be*-NPST *sad* **.** = (11ii)
$^{P}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau];\ [s|\ sad_{\top\omega}\langle s, \text{CTR}\ \top\varepsilon\rangle,\ \top\tau \subset_i \vartheta_{\top\omega}\ s];\ ^{\top}[p|\ p = \top\omega||]$

$^{\top}w_0 \in\ ^{\top}p_1 \subseteq p_0$	•	$^{\top}e_0$: e_0–ctr speaks, updates CG to $^{\top}p_1$
	|	$^{\top}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
	•	e_1: Jim leaves
	————	$s_1 = [\![\text{CON}]\!](e_1)$: Jim is gone (at $^{\top}t_0$)
	——	s_2: e_0-ctr is sad (at $^{\top}t_0$)

In (12i) the past tense presupposition must be accommodated (we write $^{\top}(A)$ for $^{\top}(\cdot)$-A)). In the next sentence (12ii) the past tense is anaphoric to the topic time from (12i)—i.e. Sue's asleep state holds at the aforementioned topical past, which includes Jim's departure.

(18) *Jim*$^{\top}$ $^{\top}$(*leave*-PST) *today* **.** = (12i)
$^{\top}[t\ x|\ x =_i jim];\ ^{P}[\top\tau <_i \vartheta_{\top\omega}\top\varepsilon];\ [e|\ leave_{\top\omega}\langle e,\top\delta\rangle,\ \vartheta_{\top\omega}\ e \subset_i \top\tau,\ \vartheta_{\top\omega}\ e \subseteq_i tod_{\top\omega}\top\varepsilon];$
$^{\top}[p|\ p = \top\omega||]$

(19) *Sue*$^{\top}$ *be*-PST *asleep* **.** = (12ii)
$^{\top}[x|\ x =_i sue];\ ^{P}[\top\tau <_i \vartheta_{\top\omega}\top\varepsilon];\ [s|\ asleep_{\top\omega}\langle s,\top\delta\rangle,\ \top\tau \subset_i \vartheta_{\top\omega}\ s];\ ^{\top}[p|\ p = \top\omega||]$

$^{\top}w_0 \in\ ^{\top}p_1 \subseteq p_0$	•	$^{\top}e_0$: e_0-ctr speaks, updates CG to $^{\top}p_1$
	|	$^{(\top)}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
	|||||||||	$^{\top}t_1$: e_0-past ($\forall v \in p_0$: $t_1 <_{\tau} [\![\vartheta]\!](w_0, e_0)$)
	•	e_1: Jim leaves (in $^{\top}t_1 \cap [\![tod]\!](w_0, e_0)$)
	————	s_2: Sue is asleep (at $^{\top}t_1$)

In (13i) -NPST on an event verb cannot refer to the default topic time, the speech instant, since an instant cannot properly include anything. Therefore, a topical future must be accommodated (by $^{\top}(\cdot)$-). Jim's departure is thus located in the future of the topic world (see Kamp and Reyle 1993). The iv- modifier, *today*, further restricts this event to the speech day. Since the verb is eventive it can also update the topic time to a subinterval of the consequent state (by -$(\cdot)^{\top}$, which must apply after $^{\top}(\cdot)$, given the definition of $(A^{\top}; B)$.)

(20) a. $(^{\top}(\textit{leave}\text{-NPST}))^{\top}$ $= \textit{leaves}$

iv: $\lambda \underline{x}\lambda \underline{w}.\ (^{\top}[t]\ ^{\top};\ (^{P}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau];\ [\underline{w} \in \top\omega\|];\ [e|\ \textit{leave}_{\underline{w}}\langle e, \text{CTR}\ e\rangle]\ ^{\perp};$

$[\text{AT}_{\underline{w}}\langle\perp\varepsilon, \top\tau\rangle, \text{CTR}\ \perp\varepsilon =_i \underline{x}]))\ ^{\perp};\ ^{\top}[t|\ t \subseteq_i \vartheta_{\underline{w}}\ \text{CON}\ \perp\varepsilon]$

b. iv: $\lambda \underline{x}\lambda \underline{w}.\ ^{\top}[t];\ ^{P}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau];\ [\underline{w} \in \top\omega\|];\ [e|\ \textit{leave}_{\underline{w}}\langle e, \underline{x}\rangle,\ \vartheta_{\underline{w}}\ e \subset_i \top\tau];$

$^{\top}[t|\ t \subseteq_i \vartheta_{\underline{w}}\ \text{CON}\ \perp\varepsilon]$ $\equiv$ (20a)

The resulting context satisfies both the tense presupposition and the modal presupposition of the vivid future WILL in the next sentence (13ii). Sue's sad state is located at the time of the consequent state of Jim's leaving, suggesting a causal relation between this event and Sue's change of state.

(21) a. $\textit{Jim}^{\top}\ (^{\top}(\textit{leave}\text{-NPST}))^{\top}\ \textit{today}.$ = (13i)

$^{\top}[x|\ x =_i \textit{jim}]\ ^{\top};\ ((^{\top}[t];\ ^{P}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau];\ [\top\omega \in \top\omega\|];\ [e|\ \textit{leave}_{\top\omega}\langle e, \top\delta\rangle,\ \vartheta_{\top\omega}\ e \subset_i \top\tau]$

$;\ ^{\top}[t|\ t \subseteq_i \vartheta_{\underline{w}}\ \text{CON}\ \perp\varepsilon])\ ^{\perp};\ [\vartheta_{\top\omega}\ \perp\varepsilon \subseteq_i \textit{tod}_{\top\omega}\top\varepsilon]);\ ^{\top}[p|\ p = \top\omega\|]$

b. $^{\top}[t\,x|\ x =_i \textit{jim}];\ ^{P}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau];\ [e|\ \textit{leave}_{\top\omega}\langle e, \top\delta\rangle,\ \vartheta_{\top\omega}\ e \subset_i \top\tau,\ \vartheta_{\top\omega}\ e \subset_i \textit{tod}_{\top\omega}\top\varepsilon];$

$^{\top}[t|\ t \subseteq_i \vartheta_{\top\omega}\ \text{CON}\ \perp\varepsilon];\ ^{\top}[p|\ p = \top\omega\|]$ $\equiv$ (21a)

(22) $\textit{Sue}^{\top}$ WILL *be*-INF *sad*. = (13ii)

$^{\top}[x|\ x =_i \textit{sue}];\ ^{P}[\vartheta_{\top\omega}\top\varepsilon <_i \top\tau];\ [s|\ \textit{sad}_{\top\omega}\langle s, \top\delta\rangle,\ \top\tau \subset_i \vartheta_{\top\omega}\ s];\ ^{\top}[p|\ p = \top\omega\|]$

$^{\top}w_0 \in\ ^{\top}p_1 \subseteq p_0$ • $^{\top}e_0$: e_0-ctr speaks, updates CG to $^{\top}p_1$
| $^{(\top)}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
||||| $^{(\top)}t_1$: e_0-future ($\forall v \in\ ^{\{\}}p_0$: $[\![\vartheta]\!](w_0, e_0) <_{\tau} t_1$)
• e_1: Jim leaves (in $^{(\top)}t_1 \cap [\![\textit{tod}]\!](w_0, e_0)$)
|||| $^{\top}t_2 \subseteq [\![\vartheta]\!](w_0, [\![\text{CON}]\!](e_1))$: e_1-consequent time
—— s_2: Sue is sad (at $^{\top}t_2$)

Thus, in root clauses WILL does not involve any modal quantification. All that matters is the future of the speech world (pace Kamp and Reyle 1993). In contrast, in conditionals WILL quantifies over branching futures (pace Thomason 1984), due to the conditional complementizer *if*. This builds a modal topic-comment sequence which elaborates a *set* of hypothetical worlds (for related ideas see Stone 1997, Bittner 2001, Brasoveanu 2007 a.o.):

if $\underline{s}/\underline{s}/\underline{s}$: $\lambda \underline{V}\lambda \underline{V}'\lambda \underline{w}.\ [v]\ ^{\perp};\ (\underline{V}\perp\omega;\ ^{\top}[p|\ p = \perp\omega\|]\ ^{\top};\ (\underline{V}'\perp\omega;\ [\text{MIN}\langle\top\Omega, \textit{att}_{\underline{w}}\ ?\varepsilon\rangle \subseteq \perp\omega\|_{?\varepsilon}]))$

Table 4 (Attitude-based ordering semantics)

Abbreviation		UC term	
• $\textit{att}_w\ s$	:=	$\lambda p.\ \textit{att}_w(s, \text{CTR}\ s, p)$	($\textit{att} \in \{\textit{bel}, \textit{exp}, \textit{des}, \ldots\}$)
$\textit{att}_w\ e$	:=	$\lambda p.\ \textit{att}_w(e, \text{CTR}\ e, p)$	($\textit{att} \in \{\textit{say}, \textit{hear}, \ldots\}$)
$\textit{att}_w\ e$	:=	$\lambda p.\ \exists s(\textit{att}_w(s, \text{CTR}\ e, p) \wedge \vartheta_w\ e \subset \vartheta_w\ s)$	($\textit{att} \in \{\textit{des}, \textit{bel}, \textit{exp}, \ldots\}$)
• $w \leq_Q v$	:=	$\forall p(p \in Q \wedge v \in p \rightarrow w \in p)$	
$\text{MIN}(p, Q)$	:=	$\lambda w.\ w \in p \wedge \forall v(v \in p \rightarrow w \leq_Q v)$	(Q-best p-worlds)
• $[\text{MIN}\langle\top\Omega, \textit{att}_{\top\omega}\ A\rangle \subseteq \perp\Omega]$			
	:=	$\lambda I\lambda j.\ Ij \wedge \forall w(w \in \text{MIN}(\top\Omega j, \textit{att}_{\perp\omega j}\ Aj) \rightarrow w \in \perp\Omega j)$	
$[\text{MIN}\langle\top\Omega, \textit{att}_{\top\omega}\ A\rangle \subseteq \perp\omega\|_A]$			
	:=	$\lambda I\lambda j.\ Ij \wedge \forall w(w \in \text{MIN}(\top\Omega j, \textit{att}_{\perp\omega j}\ Aj) \rightarrow w \in \perp\omega\{\lambda i.\ Ii \wedge Ai = Aj\})$	

In (14) *if* first adds a hypothetical world (v_1 in the model) to each $\bot$-list of the input and then elaborates by a modal topic-comment sequence. The modal topic is the set ($^{\top}r_1$) of hypothetical worlds that satisfy the antecedent, including tense (-NPST restricts v_1 to the common ground, pace Stalnaker 1975). Of these, the antecedent worlds that best fit the relevant attitude in the topic world of the center of empathy (e.g. what the speaker *bel*ieves, *exp*ects, or *des*ires) also satisfy the consequent. Finally, the set of topic worlds where this attitude is held is introduced as the primary topic ($^{\top}p_1$, adapting Lewis 1973, Kratzer 1981).

(23) *if* *Jim*$^{\top}$ ($^{\mathbf{t}}$(*leave*-NPST))$^{\mathbf{t}}$ *Sue*$^{\top}$ WILL *be*-INF *sad* . = (14)

$^{\top}[t\, x|\ x =_i jim]$; $^{\mathrm{P}}[\vartheta_{\top\omega}\top\varepsilon \leq_i \top\tau]$; $[v|\ v \in \top\omega||]$; $[e|\ leave_{\bot\omega}\langle e, \top\delta\rangle,\ \vartheta_{\bot\omega}\, e \subset_i \top\tau]$;
$^{\top}[t|\ t \subseteq_i \vartheta_{\bot\omega}\ \mathrm{CON}\ \bot\varepsilon]$; $^{\top}[p|\ p = \bot\omega||]^{\top}$; $(^{\top}[x|\ x =_i sue]$; $^{\mathrm{P}}[\vartheta_{\top\omega}\top\varepsilon <_i \top\tau]$; $^{\mathrm{P}}[\bot\omega \in \top\omega||]$;
$[s|\ sad_{\bot\omega}\langle s, \top\delta\rangle,\ \top\tau \subset_i \vartheta_{\bot\omega}\, s]$; $[\mathrm{MIN}\langle\top\Omega, exp_{\top\omega}\top\varepsilon\rangle \subseteq \bot\omega||_{\top\tau}])$; $^{\top}[p|\ p = \top\omega||]$

$^{\top}w_0 \in {}^{\top}p_1 \subseteq {}^{(\top)}p_0$ • $^{\top}e_0$: e_0-ctr speaks, expects $Q_1 = \{q_1, \ldots\}$
| $^{(\top)}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant

~~~~~~

$v_1 \in {}^{(\top)}r_1 \subseteq p_0$ $^{(\top)}r_1$: topical subdomain of p_0
|||| $^{(\top)}t_1$: e_0-future ($\forall v \in p_0$: $[\![\vartheta]\!](w_0, e_0) <_{\tau} t_1$)
• e_1: Jim leaves (in $^{\top}t_1$)
|||| $^{\top}t_2 \subseteq [\![\vartheta]\!](v_1, [\![\mathrm{CON}]\!](e_1))$: e_1-consequent time

~~~~~~

$v_1 \in \min(r_1, Q_1)$ Q_1-best r_1-worlds (e_0-expectation realized)
—— s_2: Sue is sad (at $^{\top}t_2$)

In this section the standard anaphoric theory of tense was recast as centering-based temporal anaphora. The new idea is that tense is a grammatical centering system that monitors and updates topic times. In the next section this idea is extended to grammatical illocutionary mood. I propose that this grammatical category is a modal analogue of tense, i.e. a grammatical centering system that monitors and updates modal discourse referents.

4. Centering theory of Kalaallisut mood

In Kalaallisut matrix verbs do not inflect for tense, but for illocutionary mood: the declarative marks assertions (see (24a)); the interrogative, questions (24b); the optative, wishes (24c); and the imperative, directives (24d). The first two moods introduce or inquire about *currently verifiable facts*, the latter two introduce *current prospects*.

(24) a. *Aallar-pu-q.*
leave-DEC$_{\mathrm{iv}}$-3S$_{(\top)}$
He has left.

b. *Aallar-p(i)-a?*
leave-QUE-3S$_{(\top)}$
Has s/he left?

c. *Aallar-li-Ø!*
leave-OPT-3S$_{!}$
Let him leave!

d. *Aallar-(g)i-t!*
leave-IMP-2S$_{!}$
Leave!

There is a separate mood paradigm for dependent verbs. This paradigm, too, contrasts currently verifiable facts, in the factual mood, and current prospects, in the hypothetical mood (e.g. (25a) vs. (25b)). In addition, dependent subjects are marked as backgrounded (⊥) or topical (⊤)—i.e. same or different than the matrix subject, which is always topical.

(25) a. *Aani aliasug-pu-q Ole aallar-m(m)-at.*
Ann sad-DEC$_{iv}$-3S$_{(\top)}$ Ole leave-FCT$_{\perp}$-3S$_{\perp}$
Ann is sad because Ole has left.
b. *Ole aallar-p(p)-at Aani aliasug-ssa-(p)u-q.*
Ole leave-HYP$_{\perp}$-3S$_{\perp}$ Ann sad-exp-DEC$_{iv}$-3S$_{(\top)}$
If/when Ole leaves Ann will (lit. is expected to) be sad.

Fact-oriented moods assert that (DEC, FCT), or inquire whether (QUE), the eventuality of the verb is a *currently verifiable fact*—i.e. an event that has already happened (see (26)), or a state that has at least begun (27), in the same world as the speech act. Current verifiability is required with or without a temporal modifier and rules out modifiers like *aqagu* 'tomorrow' in the absence of future-oriented attitude states such as expectation (see (27)).

(26) a. *Ole aallar-pu-q.*
Ole leave-DEC$_{iv}$-3S$_{(\top)}$
Ole has left.
b. *Ole ullumi aallar-pu-q.*
Ole today leave-DEC$_{iv}$-3S$_{(\top)}$
Ole left today.
c. *Ole aallar-p(i)-a?*
Ole leave-QUE-3S$_{(\top)}$
Has Ole left?
d. *Ole ullumi aallar-p(i)-a?*
Ole today leave-QUE-3S$_{(\top)}$
Did Ole leave today?

(27) a. (**Aqagu*) *ulapig-pu-nga.*
(*tomorrow) busy-DEC$_{iv}$-1S
I am busy (*tomorrow).
b. *Aqagu siku-mi sivisuu-mik aallar-sima-ssa-(p)u-nga.*
tomorrow ice-LOC long-MOD leave-prf-exp-DEC$_{iv}$-1S
I will (lit. expect | am expected to) be gone out on the ice a long time tomorrow.

To analyze these data I propose four basic categories: sentence and three types of bound pronouns (see K1). The category-to-type rule is given in K2 and illustrated in Table 5.

K1 (Categories for Kalaallisut)
i. s, pn_{ω}, pn_{δ}, pn_{τ} are Kalaallisut categories;
ii. If *X* and *Y* are Kalaallisut categories, then so are *X/Y* and *X\Y*
ABBREVIATIONS: $x_a = x\backslash pn_a$, $\underline{s} = s_{\omega}$, $cn_a = s_a\backslash pn_{\omega}$

K2 (Kalaallisut category-to-type rule)
i. **tp**(s) = [ ], **tp**(pn_{ω}) = W, **tp**(pn_{δ}) = D, **tp**(pn_{τ}) = T
ii. **tp**(*X/Y*) = **tp**(*X\Y*) = **tp**(*Y*)**tp**(*X*)
ABBREVIATION: D_{δ} = D, D_{τ} = T

Table 5

Kalaallisut item (gloss)	*Category*	*UC type a*	$u \in Var_a$
leave-, *sad-*, *busy-*	$\underline{s}_\delta$	[DW]	$\underline{P}$
-exp	$\underline{s}\backslash\underline{s}$	[W][W]	$\underline{F}$
-prf, -OPT, -IMP	$\underline{s}_\delta\backslash\underline{s}_\delta$	[DW][DW]	
-DEC, -QUE	$s_\delta\backslash\underline{s}_\delta$	[DW](D[ ])	
-FCT	$(s\backslash s)_\delta\backslash\underline{s}_\delta$	[DW](D[[ ]])	
-HYP	$(\underline{s}/\underline{s})_\delta\backslash\underline{s}_\delta$	[DW](D[[W]W])	
-1S$_!$, -2S$_!$, -3S$_!$	$s\backslash\underline{s}_\delta$	[DW][ ]	
-1S, -2S, -3S$_{(\top)}$, 3S$_\top$, -3S$_{(\perp)}$, -3S$_\perp$	$x\backslash x_\delta$	(D…)…	
Ole-, ice-, today-, long-	cn_a	[WD$_a$]	$\underline{N}_a$
-$^\perp$ (for cn_δ), -$^\top$	$(s/s)\backslash cn_a$	[WD$_a$][[ ]]	
-$^\perp$ (for cn_τ), -MOD, -LOC	$(\underline{s}/\underline{s})\backslash cn_a$	[WD$_a$][[W]W]	

In contrast to English, verbal roots introduce eventualities together with the subject. The subject is preserved by derivational x\x suffixes (e.g. *-prf*, *-exp*), which add eventualities, and prospective $\underline{s}_\delta\backslash\underline{s}_\delta$ moods (-OPT, -IMP), which add realization spheres.

leave- $\underline{s}_\delta$: $\lambda\underline{x}\lambda\underline{w}.\ [e|\ leave_{\underline{w}}\langle e, \underline{x}\rangle]$
sad- $\underline{s}_\delta$: $\lambda\underline{x}\lambda\underline{w}.\ [s|\ sad_{\underline{w}}\langle s, \underline{x}\rangle]$
-prf $\underline{s}_\delta\backslash\underline{s}_\delta$: $\lambda\underline{P}\lambda\underline{x}\lambda\underline{w}.\ \underline{P}\ \underline{x}\ \underline{w}\ ^\perp;\ [s|\ s =_i \text{CON EVT} \perp a]$
-exp $\underline{s}\backslash\underline{s}$: $\lambda\underline{V}\lambda\underline{w}.\ \underline{V} \perp\omega\ ^\perp;\ [\text{EVT} \perp a \subset_{\perp\omega} \text{CON}\ ?\varepsilon];\ [s|\ \perp a <_{\perp\omega} \text{END}\ s];\ [\text{MIN}\langle\top\Omega, exp_{\underline{w}} \perp\sigma\rangle$
$\subseteq \perp\omega\|_{\perp\sigma}]$

-OPT $\underline{s}_\delta\backslash\underline{s}_\delta$: $\lambda\underline{P}\lambda\underline{x}\lambda\underline{w}.\ ^{\text{P}}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR} \top\varepsilon\rangle, \text{DAT} \top\varepsilon \neq_i \underline{x}];\ \underline{P}\ \underline{x} \perp\omega\ ^\perp;\ [\text{EVT} \perp a \subset_{\perp\omega} \text{CON} \top\varepsilon];$
$[p|\ p = \perp\omega\|];\ [\text{MIN}\langle\top\Omega, des_{\underline{w}}\top\varepsilon\rangle \subseteq \perp\Omega]$
-IMP $\underline{s}_\delta\backslash\underline{s}_\delta$: $\lambda\underline{P}\lambda\underline{x}\lambda\underline{w}.\ ^{\text{P}}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR} \top\varepsilon\rangle, \text{DAT} \top\varepsilon =_i \underline{x}\rangle];\ \underline{P}\ \underline{x} \perp\omega\ ^\perp;\ [\text{EVT} \perp a \subset_{\perp\omega} \text{CON} \top\varepsilon];$
$[p|\ p = \perp\omega\|];\ [\text{MIN}\langle\top\Omega, say_{\underline{w}}\top\varepsilon\rangle \subseteq \perp\Omega]$
-DEC $s_\delta\backslash\underline{s}_\delta$: $\lambda\underline{P}\lambda\underline{x}.\ ^{\text{P}}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR} \top\varepsilon\rangle];\ \underline{P}\ \underline{x} \top\omega\ ^\perp;\ [\text{AT}_{\top\omega}\{\perp a, \top\tau\}];\ [\text{EVT} \perp a <_{\top\omega} \top\varepsilon];$
$^{\top}[p|\ p = \top\omega\|]$
-QUE $s_\delta\backslash\underline{s}_\delta$: $\lambda\underline{P}\lambda\underline{x}.\ ^{\text{P}}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR} \top\varepsilon\rangle];\ \underline{P}\ \underline{x} \perp\omega\ ^\perp;\ [\text{AT}_{\perp\omega}\{\perp a, \top\tau\}];\ [\text{EVT} \perp a <_{\perp\omega} \top\varepsilon];$
$[p|\ p = \perp\omega\|];\ [ask_{\top\omega}\{\top\varepsilon, \text{CTR} \top\varepsilon, \perp\Omega\|\}]$

Only derivational suffixes allow further x\x suffixes because all x\x-suffixes require an eventuality on top of the ⊥-list. The perfect *-prf* adds the consequent state of the input event. The prospective *-exp* adds a state of expectation concerning the consequent state of an antecedent perspective point ($?\varepsilon$). In the expected worlds an $\underline{s}$-event is realized within this temporal frame and is a verifiable fact by the end of this attitudinal state. Prospective moods are similar but performative: the perspective point is the speech event (see Lewis 1972, Schwager 2005).

The four illocutionary moods (-OPT, -IMP, -DEC, -QUE) form a grammatical system for modal (re)centering, parallel to temporal (re)centering by tense. Parallel to *tense presuppositions*, which relate the speech act to the topic time, *illocutionary presuppositions* relate the speech act to the topic world. Both grammatical systems locate eventualities in the evaluation world ($?\omega$) at the topic time ($\top\tau$). In English this update is local, $[\text{AT}_W\langle A, T\rangle]$, whereas in Kalaallisut it is global, $[\text{AT}_W\{A, T\}]$ (see Table 2). Finally, parallel to the topic time update by tense, illocutionary moods introduce modal discourse referents. The declarative mood introduces the updated common ground as the primary topic (cf. Stalnaker 1978). The interrogative mood introduces the possible direct answers into the background (cf. Hamblin 1973). Prospective moods introduce background realization spheres (cf. Lewis 1972). By D8, a sentence has a truth value just in case it introduces a proposition as the primary topic. This correctly predicts that all and only declarative sentences have truth values.

Dependent moods turn verbal $\underline{\mathrm{s}}_\delta$-bases into elaborating (s\s) or topic-setting ($\underline{\mathrm{s}}/\underline{\mathrm{s}}$) modifiers. The factual mood (-FCT) introduces an entailment of the current common ground ($\top\omega||$) that the matrix event ($\bot a$) lies within the consequent state of an $\underline{\mathrm{s}}_\delta$-event ($\bot b$). This elaboration suggests a causal link from the $\underline{\mathrm{s}}_\delta$-event to the matrix event. The hypothetical mood (-HYP) introduces a modal topic: the set of worlds in the anaphoric modal base ($?\omega||$) where an $\underline{\mathrm{s}}_\delta$-event is a current prospect (from the perspective of $?\varepsilon$). The matrix must comment on this topic ($\top\Omega$) so it must contain a prospective item (e.g. -*exp*, -OPT, or -IMP).

-FCT $(\mathrm{s}\backslash\mathrm{s})_\delta\backslash\underline{\mathrm{s}}_\delta$: $\lambda\underline{P}\lambda\underline{x}\lambda K.\ (K\ ^\bot;\ [t|\ t =_i\ \vartheta_{\top\omega}\ \mathrm{EVT}\ \bot a])\ ^\bot;\ (\underline{P}\ \underline{x}\ \bot\omega\ ^\bot;\ [\bot\tau \subset_i \vartheta_{\top\omega}\ \mathrm{CON\ EVT}\ \bot b]);$
$[\top\omega|| \subseteq \bot\omega||]$

-HYP $(\underline{\mathrm{s}}/\underline{\mathrm{s}})_\delta\backslash\underline{\mathrm{s}}_\delta$: $\lambda\underline{P}\lambda\underline{x}\lambda\underline{V}\lambda\underline{w}.\ \underline{P}\ \underline{x}\ \bot\omega\ ^\bot;\ [\mathrm{EVT}\ \bot a \subset_{\bot\omega}\ \mathrm{CON}\ ?\varepsilon];\ [\bot\omega \in\ ?\omega||];\ ^\top[p|\ p = \bot\omega||]\ ^\top;\ \underline{V}\ \underline{w}$

Kalaallisut subject 'agreement' corresponds to English subject pronouns (see Jelinek 1984). An inflected Kalaallisut 'verb' thus translates into an English sentence. An inflected noun sets a topic ($-^\top$) or background ($-^\bot$) for the modified s or $\underline{\mathrm{s}}$ or elaborates the $\underline{\mathrm{s}}$-event:

-1S	$\mathrm{s}\backslash\mathrm{s}_\delta$: $\lambda P.\ P\ (\mathrm{CTR}\ \top\varepsilon)^\circ$	-3S$_\bot$	$\mathrm{s}\backslash\mathrm{s}_\delta$: $\lambda P.\ P\ \bot\delta$
-2S	$\mathrm{s}\backslash\mathrm{s}_\delta$: $\lambda P.\ P\ (\mathrm{DAT}\ \top\varepsilon)^\circ$	-3S$_{(\top)}$	$\mathrm{s}\backslash\mathrm{s}_\delta$: $\lambda P.\ P\ \top\delta$
-2S$_!$	$\mathrm{s}\backslash\underline{\mathrm{s}}_\delta$: $\lambda\underline{P}.\ \underline{P}\ (\mathrm{DAT}\ \top\varepsilon)^\circ\ \top\omega$	-3S$_!$	$\mathrm{s}\backslash\underline{\mathrm{s}}_\delta$: $\lambda\underline{P}.\ \underline{P}\ \top\delta\ \top\omega$

Ole-	cn_δ: $\lambda\underline{w}\lambda\underline{x}.\ [\underline{x} =_i ole]$	*today-*	cn_τ: $\lambda\underline{w}\lambda\underline{t}.\ [\underline{t} \subseteq_i tod_{\top\omega}\top\varepsilon]$
ice-	cn_δ: $\lambda\underline{w}\lambda\underline{x}.\ [ice_{\underline{w}}\langle\underline{x},\ ?\tau\rangle]$	*long-*	cn_τ: $\lambda\underline{w}\lambda\underline{t}.\ [long\{\underline{t},\ \underline{t}||\}]$

$-^\top$ $(\mathrm{s}/\mathrm{s})\backslash\mathrm{cn}_a$: $\lambda\underline{N}_a\,\lambda K.\ \underline{N}_a\ \top\omega\ \top a\ ^\top;\ K$
$-^\bot$ $(\mathrm{s}/\mathrm{s})\backslash\mathrm{cn}_\tau$: $\lambda\underline{N}_\tau\,\lambda K.\ \underline{N}_\tau\ \top\omega\ \bot\delta\ ^\bot;\ K$
$(\underline{\mathrm{s}}/\underline{\mathrm{s}})\backslash\mathrm{cn}_\tau$: $\lambda\underline{N}_\tau\,\lambda\underline{V}\lambda\underline{w}.\ \underline{N}_\tau\ \underline{w}\ \bot\tau\ ^\bot;\ (\underline{V}\ \underline{w}\ ^\bot;\ [\vartheta_{\underline{w}}\ \bot b \subseteq_i \bot\tau])$

-MOD $(\underline{\mathrm{s}}/\underline{\mathrm{s}})\backslash\mathrm{cn}_\tau$: $\lambda\underline{N}_\tau\,\lambda\underline{V}\lambda\underline{w}.\ \underline{V}\ \underline{w}\ ^\bot;\ \underline{N}_\tau\ \underline{w}\ \vartheta_{\underline{w}}\ \bot b$
-LOC $(\underline{\mathrm{s}}/\underline{\mathrm{s}})\backslash\mathrm{cn}_\delta$: $\lambda\underline{N}_\delta\,\lambda\underline{V}\lambda\underline{w}.\ \underline{V}\ \underline{w}\ ^\bot;\ \underline{N}_\delta\ \underline{w}\ \pi_{\underline{w}}\ \bot b$

Finally, I assume that lexical accommodation allows verbs to accommodate their hypothetical world arguments (by $-^\bot(\cdot)$) and nouns to accommodate their nominal referents (by $-^\top(\cdot)$ or $-^\bot(\cdot)$). Moreover, a verbal base ($\underline{\mathrm{s}}_\delta$) may be modified by pre-verbal $\underline{\mathrm{s}}/\underline{\mathrm{s}}$ (licensed by $-^\backslash(\cdot)$). This modifier may be a topic- or background-settng noun which has itself undergone type lifting (from s/s to $\underline{\mathrm{s}}/\underline{\mathrm{s}}$, by $-(\cdot)^+$).

$^\bot(\cdot)$- $\mathrm{s}_a\backslash\mathrm{s}_a$: $\lambda P_a\,\lambda\underline{u}_a.\ [u_a]\ ^\bot;\ P_a\ \underline{u}_a$
$^\top(\cdot)$- $\mathrm{s}_a\backslash\mathrm{s}_a$: $\lambda P_a\,\lambda\underline{u}_a.\ ^\top[u_a]\ ^\top;\ P_a\ \underline{u}_a$
$-(\cdot)^+$ $(\underline{\mathrm{s}}/\underline{\mathrm{s}})\backslash(\mathrm{s}/\mathrm{s})$: $\lambda\underline{K}\lambda\underline{V}\lambda\underline{w}.\ \underline{K}\ (\underline{V}\ \underline{w})$
$-^\backslash(\cdot)$ $\underline{\mathrm{s}}_\delta\backslash(\underline{\mathrm{s}}/\underline{\mathrm{s}})\backslash\underline{\mathrm{s}}_\delta$: $\lambda\underline{P}\lambda\underline{F}\lambda\underline{x}\lambda\underline{w}.\ (\underline{F}\ (\underline{P}\ \underline{x}))\ \underline{w}$

For example, in (27a) the root introduces a busy state (s_1). The declarative mood locates this state in the same world ($^\top w_0$) as the speech act (e_0). It also asserts that the state is (e_0)-verifiable and holds at the topic time (the speech instant, by discourse-initial default). The subject is -1S so the busy state is predicated of the speaker. Finally, the primary topic is updated to the resulting common ground (the set of surviving topic worlds, $^{\top}p_1$).

(28) *busy*-DEC$_{iv}$-1S = (27a)
$^{P}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR } \top\varepsilon\rangle]$; $[s|\ busy_{\top\omega}\langle s, \text{CTR } \top\varepsilon\rangle, \top\tau \subset_i \vartheta_{\top\omega}\ s, \text{BEG } s <_{\top\omega} \top\varepsilon]$; $^{\top}[p|\ p = \top\omega||]$

$^{\top}w_0 \in {}^{\top}p_1 \subseteq p_0$ • $^{\top}e_0$: e_0-ctr speaks, updates common ground to $^{\top}p_1$
| $^{\top}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
——— s_1: e_0-ctr is busy (at $^{\top}t_0$)
• $[\![\text{BEG}]\!](s_1)$: e_0-ctr gets busy, verifiable fact from $^{\top}e_0$

In (26a) a topic-setting noun introduces Ole as a topic and the third person declarative ‘verb’ (s) comments. The topic time is the speech instant so the verbal event (e_1) is required, by the global update $[\text{AT}_{\top\Omega}\{\perp\varepsilon, \top\tau\}]$ to have a current consequent state (see (30)).

(29) $^{\top}$*Ole*-$^{\top}$ *leave*-DEC$_{iv}$-3S$_{(\top)}$ = (26a)
$^{\top}[x|\ x =_i ole]\ ^{\top}$; $(^{P}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR } \top\varepsilon\rangle]$; $[e|\ leave_{\top\omega}\langle e, \top\delta\rangle]$; $[\text{AT}_{\top\Omega}\{\perp\varepsilon, \top\tau\}]$; $[\perp\varepsilon <_{\top\omega} \top\varepsilon]$
; $^{\top}[p|\ p = \top\omega||])$

(30) a. $*\langle p_0, e_0\rangle[\![^{\top}[x|\ x =_i ole]$; $^{P}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR } \top\varepsilon\rangle]$; $[e|\ leave_{\top\omega}\langle e, \top\delta\rangle]]\!]^{g}$ =: c_1
$= {}^{\chi}\{\langle\langle a, t, w, p_0, e_0\rangle, \langle e_1\rangle\rangle|\ w \in {}^{\{\}}p_0 \wedge t = [\![\vartheta]\!](w, e_0) \wedge a = [\![ole]\!] \wedge \langle e_1, a\rangle \in {}^{\{\}}[\![leave]\!](w)\}$
b. $c_1[\![[\text{AT}_{\top\omega}\{\perp\varepsilon, \top\tau\}]]\!]^{g}$
$= {}^{\chi}\{\langle\langle a, t, w, p_0, e_0\rangle, \langle e_1\rangle\rangle|\ \langle\langle a, t, w, p_0, e_0\rangle, \langle e_1\rangle\rangle \in c_1 \wedge t \subset [\![\vartheta]\!](w, [\![\text{CON}]\!](e_1))\}$

$^{\top}w_0 \in {}^{\top}p_1 \subseteq p_0$ • $^{\top}e_0$: e_0-ctr speaks, updates CG to $^{\top}p_1$
| $^{\top}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
• e_1: Ole leaves, verifiable fact from $^{\top}e_0$
——— $[\![\text{CON}]\!](e_1)$: Ole is gone (at $^{\top}t_0$)

In contrast, in (26b) *today*-$^{\top}$ updates the topic time to part of the e_0-day. The global update $[\text{AT}_{\top\omega}\{\perp\varepsilon, \top\tau\}]$ then reduces to the local update $[\text{AT}_{\top\omega}\langle\perp\varepsilon, \top\tau\rangle]$ (see Table 2) so in this context events are located as in English (see (32a, b) and the model below).

(31) $^{\top}$*Ole*-$^{\top}$ $^{\top}$*today*-$^{\top}$ *leave*-DEC$_{iv}$-3S$_{(\top)}$ = (26b)
$^{\top}[x|\ x =_i ole]\ ^{\top}$; $(^{\top}[t|\ t \subseteq_i tod_{\top\omega}\top\varepsilon]\ ^{\top}$; $(^{P}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR } \top\varepsilon\rangle]$; $[e|\ leave_{\top\omega}\langle e, \top\delta\rangle]$;
$[\text{AT}_{\top\omega}\{\perp\varepsilon, \top\tau\}]$; $[\perp\varepsilon <_{\top\omega} \top\varepsilon]$; $^{\top}[p|\ p = \top\omega||]))$

(32) a. $*\langle p_0, e_0\rangle[\![^{\top}[x|\ x =_i ole\rangle]$; $^{\top}[t|\ t \subseteq_i tod_{\top\omega}\top\varepsilon]$; … ; $[e|\ leave_{\top\omega}\langle e, \top\delta\rangle]]\!]^{g}$ =: c_2
$= {}^{\chi}\{\langle\langle t', a, t, w, p_0, e_0\rangle, \langle e_1\rangle\rangle|\ w \in {}^{\{\}}p_0 \wedge t = [\![\vartheta]\!](w, e_0) \wedge a = [\![ole]\!] \wedge t' \subseteq [\![tod]\!](w_0, e_0)$
$\wedge \langle e_1, a\rangle \in {}^{\{\}}[\![leave]\!](w)\}$
b. $c_2[\![[\text{AT}_{\top\omega}\{\perp\varepsilon, \top\tau\}]]\!]^{g}$
$= {}^{\chi}\{\langle\langle t', a, t, w, p_0, e_0\rangle, \langle e_1\rangle\rangle|\ \langle\langle t', a, t, w, p_0, e_0\rangle, \langle e_1\rangle\rangle \in c_2 \wedge [\![\vartheta]\!](w, e_1) \subset t'\}$

$^{\top}w_0 \in {}^{\top}p_1 \subseteq p_0$ • $^{\top}e_0$: e_0-ctr speaks, updates CG to $^{\top}p_1$
| $^{(\top)}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
|||||||||||||||||||||| $^{\top}t_1 \subseteq [\![tod]\!](w_0, e_0)$: part of e_0-day
• e_1: Ole leaves (dur. $^{\top}t_1$), verifiable fact from $^{\top}e_0$

In questions temporal reference is the same but modal reference is different. The only new information added by the interrogative mood is that this is an act of asking a question. A question does not introduce any propositional topic so it has no truth value (by D8). Instead it introduces a set of background propositions—direct answers—and inquires which answer, if any, is true.

(33) $^{\top}$*Ole*-$^{\top}$ $^{\bot}$*leave*-QUE-3S$_{(\top)}$ = (26c)
$^{\top}[x|\ x =_i ole]\ ^{\top}$; $(^{P}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR}\ \top\varepsilon\rangle]; [e\ v|\ leave_v\langle e, \top\delta\rangle]; [\text{AT}_{\bot\omega}\{\bot\varepsilon, \top\tau\}];$
$[\bot\varepsilon <_{\bot\omega} \top\varepsilon]; [p|\ p = \bot\omega||]; [ask_{\top\omega}\{\top\varepsilon, \text{CTR}\ \top\varepsilon, \bot\Omega||\}])$

$^{\top}w_0 \in {}^{\top}p_1 \subseteq p_0$ • $^{\top}e_0$: e_0-ctr speaks, asks question $\{q_1\}$
| $^{\top}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
~~~~~~
$v_1 \in q_1 \subseteq D_\omega$ q_1: *yes*-answer to question $\{q_1\}$
• e_1: Ole leaves, verifiable fact from $^{\top}e_0$
——— $[\![\text{CON}]\!](e_1)$: Ole is gone (at $^{\top}t_0$)

Sentences in prospect-oriented moods likewise have no truth values. In contrast to fact-oriented moods, they introduce current prospects. There is no reference to the topic time so any temporal noun (e.g. in (34)) must elaborate the verbal event (see analysis in (35)):

(34) *Ole ullumi aallar-li-Ø*!
Ole today leave-OPT-3S$_!$
Let Ole leave today!

(35) a. $^{\bot}$*today*-$^{\bot}$ $\vdash$ $\underline{s}/\underline{s}$: $\lambda\underline{V}\lambda\underline{w}.\ [t|\ t \subseteq_i tod_{\top\omega}\ \top\varepsilon]\ ^{\bot}; (\underline{V}\ \underline{w}\ ^{\bot}; [\vartheta_{\underline{w}}\ \bot\varepsilon \subseteq_i \bot\tau])$
b. $^{\backslash}$($^{\bot}$*leave*-)-OPT-3S$_!$
s\\($\underline{s}/\underline{s}$): $\lambda\underline{F}.\ ^{P}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR}\ \top\varepsilon\rangle, \text{DAT}\ \top\varepsilon \neq_i \top\delta]; (\underline{F}\ \lambda\underline{w}([v]\ ^{\bot}; [e|\ leave_{\underline{w}}\langle e, \top\delta\rangle]))\ \bot\omega\ ^{\bot};$
$[\bot\varepsilon \subset_{\bot\omega} \text{CON}\ \top\varepsilon]; [p|\ p = \bot\omega||]; [\text{MIN}\langle\top\Omega, des_{\top\omega}\top\varepsilon\rangle \subseteq \bot\Omega]$
c. $^{\top}$*Ole*-$^{\top}$ $^{\bot}$*today*-$^{\bot}$ $^{\backslash}$($^{\bot}$*leave*-)-OPT-3S$_!$
$^{\top}[x|\ x =_i ole]; ^{P}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR}\ \top\varepsilon\rangle, \text{DAT}\ \top\varepsilon \neq_i \top\delta]; [e\ v\ t|\ t \subseteq_i tod_{\top\omega}\top\varepsilon, leave_v\langle e, \top\delta\rangle,$
$\vartheta_v\ e \subseteq_I t, e \subset_v \text{CON}\ \top\varepsilon]; [p|\ p = \bot\omega||]; [\text{MIN}\langle\top\Omega, des_{\top\omega}\top\varepsilon\rangle \subseteq \bot\Omega]$

The optative (34) adds the performative information that the speaker has certain desires (set of propositions, Q_0)—to wit, that Ole leave today within the consequent state of this speech act. In general, optatives do not introduce any topical propositions so they have no truth values. Instead, they have realization conditions (Q_0-best p_0-worlds, cf. Heim 1992).
~~~~~~

$^{\top}w_0 \in {}^{\top}p_1 \subseteq p_0$ • $^{\top}e_0$: e_0-ctr speaks, has desires $Q_0 = \{q_1, \ldots q_n\}$
| $^{\top}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
~~~~~~
$v_1 \in \min(p_0, Q_0)$ Q_0-best p_0-worlds (desired e_0-prospect realized)
|||||||||| $t_1 \subseteq [\![tod]\!](w_0, e_0)$: part of e_0-day
||||||||||| $[\![\vartheta]\!](v_1, [\![\text{CON}]\!](e_0))$: realization frame
• e_1: Ole leaves in $t_1 \cap [\![\vartheta]\!](v_1, [\![\text{CON}]\!](e_0))$

Mutatis mutandis this story generalizes to the derivational prospective suffix *-exp*. In (27b) the scope of this suffix is modified by three nouns. These are composed (by >**B**, into (36a)) and licensed as a cluster (by $-^{\backslash}(\cdot)$). On the salient reading, the perspective point is the speech event ($?\varepsilon = \top\varepsilon$). The resulting update is equivalent to (36b).

(36) a. $^{\perp}$*tomorrow*-$^{\perp}$ *ice*-LOC *long*-MOD
$\underline{s}/\underline{s}$: $\lambda \underline{V} \lambda \underline{w}(([t|\ t \subseteq_i tmr_{\top\omega} \top\varepsilon]\ ^{\perp}; (\underline{V}\ \underline{w}\ ^{\perp}; [\vartheta_{\underline{w}} \perp\sigma \subseteq_i \perp\tau]))\ ^{\perp}; [ice_{\underline{w}}\langle \pi_{\underline{w}} \perp\sigma, \perp\tau\rangle])\ ^{\perp}$;
$[long\{\vartheta_{\underline{w}} \perp\sigma, \vartheta_{\underline{w}} \perp\sigma||\}]$
b. ^{t}*tomorrow*-$^{\perp}$ *ice*-LOC *long*-MOD $^{\backslash}$(^{v}*leave-prf-*)-*exp*-DEC$_{iv}$-1S = (27b)
$^{\text{P}}[spk_{\top\omega}\langle \top\varepsilon, \text{CTR}\ \top\varepsilon\rangle]; [s\ e\ v\ t|\ t \subseteq_i tmr_{\top\omega}\top\varepsilon, leave_v\langle e, \text{CTR}\ \top\varepsilon\rangle, s =_i \text{CON}\ e, \vartheta_v\ s \subseteq_i t,$
$ice_v\langle \pi_v \perp\sigma, \perp\tau\rangle]; [long\{\vartheta_{\perp\omega} \perp\sigma, \vartheta_{\perp\omega} \perp\sigma||\}]; [\text{BEG} \perp\sigma \subset_{\perp\omega} \text{CON}\ \top\varepsilon]; [s|\ \perp\sigma <_{\perp\omega} \text{END}\ s]$
$; [\text{MIN}\langle \top\Omega, exp_{\top\omega} \perp\sigma\rangle \subseteq \perp\omega||_{\perp\sigma}]; [\top\tau \subset_i \vartheta_{\top\omega} \perp\sigma, \text{BEG} \perp\sigma <_{\top\omega} \top\varepsilon]; {}^{\top}[p|\ p = \top\omega||]$

On this reading, (27b) updates the input common ground (p_0) to the topical output ($^{\top}p_1$), where there is a (e_0-)current state of expectation (s_2). What is expected is a long consequent state (s_1) of the speaker's departure on a day trip (i.e. s_1 is the state of being away on this trip). More precisely, the temporal background-setting modifier *tomorrow*-$^{\perp}$ locates the expected state (s_1) within the day after the speech day; the spatial locative locates it on ice; and the oblique temporal modifier (*long*-MOD) further requires it to last long for a day trip on ice. In the (p_0-)worlds that best fit the (s_2-)expectations (i.e. Q_2-best p_0-worlds, $\min(p_0, Q_2)$) the expected consequent state (s_1) begins within the consequent state of the perspective point (e_0) and its completion is a verifiable fact by the end of this state of expectation (s_2).

$^{\top}w_0 \in {}^{\top}p_1 \subseteq p_0$ • $^{\top}e_0$: e_0-ctr speaks, updates CG to $^{\top}p_1$
| $^{\top}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
———————— s_2: s_2-ctr has expectations $Q_2 = \{q_{2.1}, \ldots q_{2.n}\}$
~~~~~~
$v_1 \in \min(p_0, Q_2)$ Q_2-best $^{(\top)}p_0$-worlds (s_2-expectations realized)
||||||||| $[\![\vartheta]\!](v_1, [\![\text{CON}]\!](e_0))$: realization frame
||||||||||||| $t_1 \subseteq [\![tmr]\!](w_0, e_0)$: part of e_0-tomorrow
• e_1: e_0-ctr leaves
—— $s_1 = [\![\text{CON}]\!](e_1)$: e_0-ctr is out on ice in t_1, long day on ice
———————— s_2: s_1 is a verifiable fact from $[\![\text{END}]\!](s_2)$

In (25b) the expectations introduced by *-exp* are restricted by an antecedent hypothesis (37a). This introduces the class of p_0-worlds where Ole leaves as a modal topic ($^{\top}r_1$). The declarative matrix comment is that in the antecedent worlds that best fit the expectations ($\min(r_1, Q_2)$) Ole's leaving results in a sad state of Ann's (see (37b) and the model below).

(37) a. $^{\bot}$*Ole*-$_{\bot}{}^{+}$ $^{\backslash}$($^{\bot}$*leave*-)-HYP$_{\bot}$-3S$_{\bot}$

$\underline{s}/\underline{s}$: $\lambda \underline{V} \lambda \underline{w}$. $[e\ v\ y|\ y =_i ole, leave_v\langle e, y\rangle, e \subset_v \text{CON} \top\varepsilon]; [\bot\omega \in \top\omega||]; {}^{\top}[p|\ p = \bot\omega||]^{\top}; \underline{V}\ \underline{w}$

b. [$^{\bot}$*Ole*-$_{\bot}{}^{+}$ $^{\backslash}$($^{\bot}$*leave*-)-HYP$_{\bot}$-3S$_{\bot}$] $^{\top}$*Ann*-$^{\top}$ $^{\backslash}$(*sad*-*exp*-)-DEC$_{iv}$-3S$_{(\top)}$ = (25b)

$^{\top}[x|\ x =_i ann]; {}^{P}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR } \top\varepsilon\rangle]; [e\ v\ y|\ y =_i ole, leave_v\langle e, y\rangle, e \subset_v \text{CON } \top\varepsilon];$
$[\bot\omega \in \top\omega||]; {}^{\top}[p|\ p = \bot\omega||]^{\top}; ([s|\ sad_{\bot\omega}\langle s, \top\delta\rangle, \text{BEG } s \subset_{\bot\omega} \text{CON } \bot\varepsilon]; [s|\ \bot\sigma <_{\bot\omega} \text{END } s]$
$; [\text{MIN}\langle\top\Omega, exp_{\top\omega}\ \bot\sigma\rangle \subseteq \bot\omega||_{\bot\sigma}]); [\top\tau \subset_i \vartheta_{\top\omega} \bot\sigma, \text{BEG } \bot\sigma <_{\top\omega} \top\varepsilon]; {}^{\top}[p|\ p = \top\omega||]$

$^{\top}w_0 \in {}^{\top}p_1 \subseteq p_0$	•	$^{\top}e_0$: e_0-ctr speaks, updates CG to $^{\top}p_1$
	|	$^{\top}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
	————————	s_2: s_2-ctr has expectations $Q_2 = \{q_{21},\ldots q_{2n}\}$
~~	~~~	~~~
$v_1 \in {}^{(\top)}r_1 \subseteq p_0$	||||||||||	$[\![\vartheta]\!](v_1, [\![\text{CON}]\!](e_0))$: antecedent realization frame
	•	e_1: Ole leaves (within $[\![\vartheta]\!](v_1, [\![\text{CON}]\!](e_0))$)
~~	~~~	~~~
$v_1 \in \min(r_1, Q_2)$		Q_2-best $^{(\top)}r_1$-worlds (s_2-expectations realized)
	||||	$[\![\vartheta]\!](v_1, [\![\text{CON}]\!](e_1))$: consequent realization frame
	———	s_1: Ann is sad, $[\![\text{BEG}]\!](s_1)$ in $[\![\vartheta]\!](v_1, [\![\text{CON}]\!](e_1))$
	————————	s_2: s_1 is a verifiable fact from $[\![\text{END}]\!](s_2)$

Finally, (25a) translates into (38). The declarative matrix clause introduces a e_0-verifiable sad state of Ann (s_1 in the model). It locates this state in the speech world ($^{\top}w_0$) at the topic time ($^{\top}t_0$) and introduces the resulting common ground as the primary topic ($^{\top}p_1$).

(38) $^{\top}$*Ann*-$^{\top}$ *sad*-DEC$_{iv}$-3S$_{(\top)}$ [$^{\bot}$*Ole*-$_{\bot}{}^{+}$ $^{\backslash}$($^{\bot}$*leave*-)-FCT$_{\bot}$-3S$_{\bot}$] = (25a)

$^{\top}[x|\ x =_i ann]; {}^{P}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR } \top\varepsilon\rangle]; [s|\ sad_{\top\omega}\langle s, \top\delta\rangle, \top\tau \subset_i \vartheta_{\top\omega}\ s, \text{BEG } s <_{\top\omega} \top\varepsilon];$
$^{\top}[p|\ p = \top\omega||]^{\bot}; [e\ v\ y\ t|\ t =_i \vartheta_{\top\omega} \text{ BEG } \bot\sigma, y =_i ole, leave_v\langle e, y\rangle, t \subset_i \vartheta_v \text{ CON } e];$
$[\top\omega|| \subseteq \bot\omega||]$

The factual elaboration adds that in all of these ($^{\top}p_1$) worlds the beginning of Ann's sad state falls within the consequent state of Ole's leaving, so this event may be a cause of Ann's sadness.

$^{\top}w_0 \in {}^{\top}p_1 \subseteq p_0$	•	$^{\top}e_0$: e_0-ctr speaks, updates CG to $^{\top}p_1$
	|	$^{\top}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
	——————	s_1: Ann is sad (at $^{\top}t_0$), $[\![\text{BEG}]\!](s_1)$ verifiable fact from e_0
	|	$t_1 = [\![\vartheta]\!](w_0, [\![\text{BEG}]\!](s_1))$: $[\![\text{BEG}]\!](s_1)$-instant
	——	$[\![\text{CON}]\!](e_1)$: Ole is gone (at t_1)
~~	~~~	~~~
$v_1 \in q_1 \subseteq D_\omega$		factual background of $^{\top}p_1$ ($^{\top}p_1 \subseteq q_1$)
	•——	e_1, $[\![\text{CON}]\!](e_1)$: Ole leaves, is gone (at t_1)

In summary, the centering theory of tense generalizes to a parallel centering theory of illocutionary mood. The basic idea is that both tense and mood are grammatical centering systems for different semantic domains: tense monitors and updates topic times, whereas mood monitors and updates modal discourse referents. Combining UC with CCG makes it possible to take the surface form of each language at face value. Lexical entries are language-specific but the UC ontology of discourse objects and the combinatory rules of CCG are universal. So far, this theory has been motivated by language-internal evidence. Section 5 provides additional evidence, from cross-linguistic comparison.

5. Translation equivalence of tense and mood

In spite of the fact that languages have different grammatical systems, a discourse in one language can be translated into any other language. For example, the English discourse (39), in the non-past tense, can be rendered in Kalaallisut, in the declarative mood, as (40).

(39)	i.	*Ole*	*has*	*left.*	ii. *Ann*	*is*	*asleep.*
		Ole	have.NPST	leave.PP	Ann	be.NPST	asleep
(40)	i.	*Ole*	*aallar-pu-q.*		ii. *Aani*	*sinig-pu-q.*	
		Ole	leave-DEC$_{iv}$-3S$_{(\top)}$		Aani	asleep-DEC$_{iv}$-3S$_{(\top)}$	

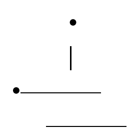
Translation equivalents have the same truth conditions. English (39) introduces two states that hold at the speech instant: the consequent state of Ole's departure and an asleep state of Ann's. Both states are located in the speech world, the default modal topic (see (41)). Thus, the temporal location in the present is grammatically encoded by non-past tense on stative verbs (*have*-, *be*-) while the modal location in the speech world reflects a universal modal default. The converse holds in Kalaallisut. Here it is the modal location in the speech world that is grammatically encoded, by the declarative mood. Temporally, Ole's departure and Ann's state of sleep are both located at the default topic time.

(41) [*Ole*$^{\top}$ *have*-NPST *leave*-PP **.**] ; [*Ann*$^{\top}$ *be*-NPST *asleep* **.**] = (39)
$^{\top}[x|\ x =_i ole]$; $^{P}[\vartheta_{\top\omega} \top\varepsilon \leq_i \top\tau]$; $[s\ e|\ leave_{\top\omega}\langle e, \top\delta\rangle, s =_i \text{CON}\ e, \top\tau \subset_i \vartheta_{\top\omega}\ s]$; $^{\top}[p|\ p = \top\omega||]$;
$^{\top}[x|\ x =_i ann]$; $^{P}[\vartheta_{\top\omega} \top\varepsilon \leq_i \top\tau]$; $[s|\ asleep_{\top\omega}\langle s, \top\delta\rangle, \top\tau \subset_i \vartheta_{\top\omega}\ s]$; $^{\top}[p|\ p = \top\omega||]$

(42) [$^{\top}$*Ole*-$^{\top}$ *leave*-DEC$_{iv}$-3S$_{(\top)}$] ; [$^{\top}$*Ann*-$^{\top}$ *asleep*-DEC$_{iv}$-3S$_{(\top)}$] = (40)
$^{\top}[x|\ x =_i ole]$; $^{P}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR}\ \top\varepsilon\rangle]$; $[e|\ leave_{\top\omega}\langle e, \top\delta\rangle, \top\tau \subset_i \vartheta_{\top\omega}\ \text{CON}\ e, e <_{\top\omega} \top\varepsilon]$;
$^{\top}[p|\ p = \top\omega||]$; $^{\top}[x|\ x =_i ann]$; $^{P}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR}\ \top\varepsilon\rangle]$; $[s|\ asleep_{\top\omega}\langle s, \top\delta\rangle, \top\tau \subset_i \vartheta_{\top\omega}\ s,$
$\text{BEG}\ s <_{\top\omega} \top\varepsilon]$; $^{\top}[p|\ p = \top\omega||]$

In a given context of utterance, $\langle p_0, e_0\rangle$, English and Kalaallisut converge on the same truth condition, represented by the following model:

$^{\top}w_0 \in {}^{\top}p_1 \subseteq p_0$



$^{\top}e_0$: e_0-speaker speaks, updates CG to $^{\top}p_1$
$^{\top}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
e_1, $[\![\text{CON}]\!](e_1)$: Ole leaves, is gone (at $^{\top}t_0$)
s_2: Ann is asleep (at $^{\top}t_0$)

The English discourse (43) is a past tense variant of (39). In Kalaallisut this discourse can be rendered as (44), which presents the content of (43i) as the main assertion (-DEC) and (43ii) as a factual elaboration (-FCT). In English (43i) a topical past ($^{\top}t_1$) must be accommodated to satisfy the presupposition of the past tense. The event of (43i) is located within this topical past restricted to today. The topical past ($^{\top}t_1$) also satisfies the presupposition of the past tense in (43ii). Thus, the state of (43ii) properly includes the topical past, which in turn includes the event of (43i).

(43)	i.	*Ole*	*left*	*today.*	ii.	*Ann*	*was*	*asleep.*
		Ole	leave.PST	today		Ann	be.PST	asleep

(44)	*Ole*	*ullumi*	*aallar-pu-q*	*Aani*	*sinig-m(m)-at.*
	Ole	today	leave-DEC$_{iv}$-3S$_{(\top)}$	Ann	asleep-FCT$_{\perp}$-3S$_{\perp}$

(45) [*Ole*$^{\top}$ $^{\top}$(*leave*-PST) *today* .] ; [*Ann*$^{\top}$ *be*-PST *asleep* .] = (43)
$^{\top}[t\,x|\,x =_i ole]; {}^{P}[\top\tau <_i \vartheta_{\top\omega}\top\varepsilon]; [e|\,leave_{\top\omega}\langle e, \top\delta\rangle, \vartheta_{\top\omega}\, e \subset_i \top\tau, \vartheta_{\top\omega}\, e \subseteq_i tod_{\top\omega}\top\varepsilon];$
$^{\top}[p|\,p = \top\omega||]; {}^{\top}[x|\,x =_i ann]; {}^{P}[\top\tau <_i \vartheta_{\top\omega}\top\varepsilon]; [s|\,asleep_{\top\omega}\langle s, \top\delta\rangle, \top\tau \subset_i \vartheta_{\top\omega}\, s];$
$^{\top}[p|\,p = \top\omega||]$

$^{\top}w_0 \in {}^{\top}p_1 \subseteq p_0$	•	$^{\top}e_0$: e_0-ctr speaks, updates CG to $^{\top}p_1$
	|	$^{(\top)}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
	|||||||	$^{\top}t_1$: topical e_0-past
	•	e_1: Ole leaves (in $^{\top}t_1 \cap [\![tod]\!](w_0, e_0)$)
	———	s_2: Ann is asleep (at $^{\top}t_1$)

In Kalaallisut (44) the main clause introduces an event of Ole leaving (e_1), locates it in the topical speech world ($^{\top}w_0$) within the speech-day, with a current consequent state at the speech instant ($^{\top}t_0$), and updates the main topic to the set of surviving topic worlds ($^{\top}p_1$). The factual elaboration adds that in all of these worlds Ole's departure falls within the consequent state of Ann's falling asleep.

(46) $^{\top}$*Ole*-$^{\top}$ $^{\perp}$*today*-$^{\perp}$ $^{\setminus}$*leave*-DEC$_{iv}$-3S$_{(\top)}$ [$^{\perp}$*Ann*-$^{\perp+}$ $^{\setminus}$($^{\perp}$*asleep*)-FCT$_{\perp}$-3S$_{\perp}$] = (44)
$^{\top}[x|\,x =_i ole]; {}^{P}[spk_{\top\omega}\langle\top\varepsilon, \text{CTR}\ \top\varepsilon\rangle]; [e\,t|\,t \subseteq_i tod_{\top\omega}\top\varepsilon, leave_{\top\omega}\langle e, \top\delta\rangle, \vartheta_{\top\omega}\ e \subset_i t,$
$\top\tau \subset_i \vartheta_{\top\omega}\ \text{CON}\ e, e <_{\top\omega}\top\varepsilon]; {}^{\top}[p|\,p = \top\omega||]\ {}^{\perp}; [s\,v\,y\,t|\,t =_i \vartheta_{\top\omega}\perp\varepsilon, y =_i ann, asleep_v\langle s, y\rangle,$
$t \subset_i \vartheta_v\ \text{CON BEG}\ s]; [\top\omega|| \subseteq \perp\omega||]$

$^{\top}w_0 \in {}^{\top}p_1 \subseteq p_0$	•	$^{\top}e_0$: e_0-ctr speaks, updates CG to $^{\top}p_1$
	|	$^{\top}t_0 = [\![\vartheta]\!](w_0, e_0)$: e_0-instant
	•	e_1: Ole leaves (in $[\![tod]\!](w_0, e_0)$), verifiable fact from $^{\top}e_0$
	———	$[\![\text{CON}]\!](e_1)$: Ole is gone
	|	$t_1 = [\![\vartheta]\!](w_0, e_1)$: e_1-instant
	———	$[\![\text{CON}]\!]([\![\text{BEG}]\!](s_1))$: Ann is asleep (at t_1)

∼∼

$v_1 \in q_1$		factual background of $^{\top}p_1$ ($^{\top}p_1 \subseteq q_1$)
	•———	$[\![\text{BEG}]\!](s_1)$, s_1: Ann falls asleep, is asleep (at t_1)
	——	$[\![\text{CON}]\!]([\![\text{BEG}]\!](s_1))$: Ann is asleep (at t_1)

This analysis accounts for the intuition that translation equivalence holds only up to a point. In the temporal domain English tenses are more restrictive than Kalaallisut moods. For example, English (47a) is incoherent because the past topic time set by *yesterday* conflicts with the presupposition of the non-past tense. In contrast, Kalaallisut (47b) is fine because this temporal update is compatible with the meaning of the declarative mood. Conversely, in the modal domain, it is Kalaallisut that is more restrictive. For instance, the English non-past generic (48a) allows an uninstantiated rule reading, which only states what is expected or desired without requiring any currently verifiable instantiating event. The Kalaallisut declarative generic (48b) does not have this reading. The declarative mood requires current verifiability. In the case of a habit, this means at least one currently verifiable instantiating event (see Bittner 2008).

(47) a. **Yesterday I am busy.*
yesterday^{T} I be.NPST busy
b. *Ippassaq ulapig-pu-nga.*
yesterday^{T} busy-DEC$_{iv}$-1S
Yesterday I was busy.

(48) a. *Members of this club help each other.*
member.PL of this club help.NPST each other
(✓ club rule, not yet instantiated)
b. *Piqatigiivvik-mi ua-ni ilaasurtaq-t ikiur-qatigiig-tar-pu-t.*
club-LOC this-LOC member-PL help-rcp-habit-DEC$_{iv}$-3P$_{(T)}$
(*club rule, not yet instantiated)

In summary, speaking up focuses attention on the speech act and thereby sets default modal and temporal topics. Because of these universal defaults, different grammatical forms can encode the same meaning. What one language encodes by explicit grammatical marking another may convey via a universal discourse-initial default.

6. Conclusion

Tense and illocutionary mood are grammatical (re)centering systems for the temporal and the modal domain, respectively. Based on English and Kalaallisut I propose that tense monitors and updates topic times, whereas illocutionary mood monitors and updates modal discourse referents. The parallels begin with presuppositions: tenses carry presuppositions that relate the speech act to the topic time, while illocutionary moods carry presuppositions that relate the speech act to the topic world. The two grammatical systems converge even closer on new information: both tenses and illocutionary moods locate eventualities in the evaluation world at the topic time. In English as well as Kalaallisut these modal-temporal location updates respect the aspectual universals of Bittner (2008), but with different details. Finally, both grammatical systems give rise to parallel recentering updates: English tenses update topic times, while Kalaallisut moods update modal discourse referents.

These semantic parallels were formalized in *Update with Centering* (UC), a dynamic logic suited to represent changing states of information and attention in discourse. Evidence from English and Kalaallisut suggests that different languages can be translated into this typed logic in a directly compositional way by the universal rules of *Combinatory Categorial Grammar* (CCG, Steedman 2000 and others). The proposed centering theory of tense and illocutionary mood accounts for temporal and modal discourse reference in English as well as Kalaallisut. In addition, the theory accounts for the translation equivalence of tense and illocutionary mood in a given utterance context. Following Stalnaker (1978) I assume that the very act of speaking up has a 'commonplace effect' on the context. It focuses attention on the speech act and thereby introduces default modal and temporal topics. These universal defaults complement language-specific grammars, e.g. English tenses and Kalaallisut moods. In a given utterance context the universal discourse-initial defaults plus language-specific grammatical marking may add up to the same truth conditions. As a consequence, temporal reference in the tenseless mood system of Kalaallisut is predictable and precise, just like modal reference in English.

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