English and Kalaallisut in CCG+UC$_2$

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1. INTRODUCTION

- SYN-SEM TRAITS: ENGLISH vs. KALAALLISUT

T1: *Argument type*: What are the nominal arg's saturating the verbal pred.?
Eng. **SA**: *s*yntactic *a*rgument phrases only (NP subject, NP object, …)
Kal. **BA**: morphologically *b*ound *a*rguments only (pn clitic|affix, n-root, …)

T2 *Prominence type*: What is the most prominent nominal relation?
Eng. **SU**: *su*bject prominent (salient gram. contrast: SUbject vs. DIrect OBject)
Kal. **TO**: *to*pic prominent (salient gram. contrast: ⊤ (topic) vs. ⊥ (bckgrnd))

T3 *Word order type*: What determines the word order?
Eng. **S**: *s*yntactic rules (e.g. S → NP VP, etc, ∴ 'rigid' word order)
Kal. **L**: *l*exical operations (H-lift, pre-H lift, post-H lift, ∴ 'free' order)

- SCOPE COROLLARY
  In a SA-language the scope of SA may be ambiguous
  In a BA-language the scope of BA is unambiguous

(Last month Ole$^\top$ ordered three books$^\bot$.)

tv$_E$. He$_\top$ hasn't received ***one$_\bot$ book*** yet. — **SA**-lg.: English
∃¬. one book is still missing
¬∃. hasn't received any

iv$_E$. ***One book*** hasn't been received yet.
∃¬. one book is still missing

tv$_K$. *Suli atuagaq ataasiq tigu-nngi(t)-la-**a**.* — **BA**-lg.: Kalallisut
still book one get-not-DEC-3S$_{(\top)}$.*3S*$_{(\bot)}$
∃¬. one book is still missing

^{P}iv$_K$. *Suli atuagaq ataasiq tigu-niqa(r)-nngi(t)-la-**q**.* — (P = passive)
still book one get-pssv-not-DEC-**3S**$_{(\top)}$
∃¬. one book is still missing

^{A}iv$_K$. *Suli atuakkamik ataatsimik tigu-**si**-nngi(t)-la-q.* — (A = antipassive)
still book-MOD one-MOD get-*antip*-not-DEC-3S$_{(\top)}$
¬∃. hasn't received any

2. UC$_1$ WITH EVENTS (UC$_2$)

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

- $\langle D\rangle^{n,m} = D^n \times D^m$ is the set of ⊤⊥-*lists* of n topical D-objects (the ⊤-*list*) and m background D-objects (the ⊥-*list*).
- For any ⊤⊥-list $i = \langle i_1, i_2\rangle \in \langle D\rangle^{n,m}$, $\top i = i_1$ and $\bot i = i_2$. Thus, $i = \langle \top i, \bot i\rangle$.
- An *n,m-infotention state* is any subset of $\langle D\rangle^{n,m}$. ∅ is the *absurd state.*

DEFINITION 2 (UC$_2$ types) The set of UC$_2$ *types* is the smallest set Θ such that (i) $\{t, \delta, \varepsilon\} \subseteq \Theta$, (ii) if $a, b \in \Theta$, then $(ab) \in \Theta$, and (iii) $s \in \Theta$.

DEFINITION 3 (UC$_2$ frames) A UC$_2$ *frame* is a set $\{D_a |\ a \in \Theta\}$ of non-empty pairwise disjoint sets D_a s.t. (i) $D_t = \{1, 0\}$, (ii) $D_{ab} = \{f |\ \emptyset \subset \mathrm{Dom}\, f \subseteq D_a \wedge \mathrm{Ran}\, f \subseteq D_b\}$, and (iii) $D_s = \cup_{n,\, m\, \geq\, 0} \langle D_\delta \cup D_\varepsilon\rangle^{n,m}$.

DEFINITION 4 (UC$_2$ syntax) Define for all $a \in \Theta$ the set of a-terms as follows

i. $Con_a \cup {}^\top Var_a \cup {}^\bot Var_a \subseteq Term_a$
ii. $\lambda u_a(B) \in Term_{ab}$, if $u_a \in {}^\top Var_a \cup {}^\bot Var_a$ and $B \in Term_b$
iii. $BA \in Term_b$, if $B \in Term_{ab}$ and $A \in Term_a$
iv. $\neg A, (A \rightarrow B), (A \wedge B), (A \vee B) \in Term_t$, if $A, B \in Term_t$
v. $\forall u_a B, \exists u_a B \in Term_t$, if $u_a \in {}^\top Var_a \cup {}^\bot Var_a$ and $B \in Term_t$
vi. $(A = B) \in Term_t$, if $A, B \in Term_a$
vii. $(u_a \cdot B) \in Term_s$, if $a \in \{\delta, \varepsilon\}$, $u \in {}^\top Var_a \cup {}^\bot Var_a$ and $B \in Term_s$
viii. $\top a_n, \bot a_n \in Term_{sa}$, if $a \in \{\delta, \varepsilon\}$ and $n \geq 1$.
ix. $A\{B\} \in Term_{at}$, if $a \in \{\delta, \varepsilon\}$, $A \in Term_{sa}$ and $B \in Term_{st}$
x. $\downarrow A, (A; B), (A^\top; B), (A^\bot; B) \in Term_{(st)st}$, if $A, B \in Term_{(st)st}$
xi. $(A \subseteq B) \in Term_t$, if $A, B \in Term_\varepsilon$
xii. $BA \in Term_\delta$, if $B \in \{$CTR, BCK, DAT$\}$ and $A \in Term_\varepsilon$

ABBREVIATIONS 1 For $f \in D_{a_1 \ldots a_n t}$, $\langle a_1, \ldots, a_n\rangle \in D_{a_1} \times \ldots D_{a_n}$, $A \subseteq D_{a_1} \times \ldots D_{a_n}$:
(i) $f(a_1, \ldots, a_n) := f(a_1)\ldots(a_n)$, (ii) ${}^{\{\}}f := \{\langle a_1, \ldots, a_n\rangle |\ f(a_1, \ldots, a_n) = 1\}$
(iii) ${}^{\chi}A = \iota f \in D_{a_1 \ldots a_n t}.(A = {}^{\{\}}f)$

DEFINITION 5 (UC$_2$-models) A UC$_2$-model is a structure $M = \langle\{D_a |\ a \in \Theta\}, \subseteq_\varepsilon, e_0, [\![\cdot]\!]\rangle$, where (i) $\{D_a |\ a \in \Theta\}$ is a UC$_2$ frame, (ii) $\subseteq_\varepsilon$ (ε-part of) is a weak partial order on D_ε, (iii) $e_0 \in D_\varepsilon$ and (iv) $[\![\cdot]\!]$ assigns to each $A \in Con_a$ a value $[\![A]\!] \in D_a$, and to $B \in \{$CTR, BCK, DAT$\}$ a value $[\![B]\!] \in D_{\varepsilon\delta}$ such that:

a. $\langle e, d, \ldots\rangle \in [\![A]\!] \rightarrow [\![\text{CTR}]\!](e) = d$ — if $A \in Con_{\varepsilon\delta\ldots t}$
b. $\langle e, d, d', \ldots\rangle \in [\![A]\!] \rightarrow [\![\text{BCK}]\!](e) = d'$ — if $A \in Con_{\varepsilon\delta\delta\ldots t}$
c. $\exists d, d' \in D_\delta$: $\langle e_0, d\rangle \in {}^{\{\}}[\![spk]\!] \wedge [\![\text{DAT}]\!](e_0) = d'$

ABBREVIATIONS 2 (Projections & dot-extensions). For any non-empty set D,

•	$(\mathsf{x})_n$ = the nth coordinate, x_n	for $\mathsf{x} \in D^{n+m}$
	$(\mathsf{x})_a$ = the subsequence of x consisting of $\mathsf{x}_i \in D_a$	for $a \in \{\delta, \varepsilon\}$
•	$(\mathsf{d} \cdot \mathsf{x}) = \langle \mathsf{d}, \mathsf{x}_1, \ldots, \mathsf{x}_n \rangle$	for $\mathsf{d} \in D$, $\mathsf{x} \in D^n$
•	$\mathsf{y} \cdot\!> \mathsf{x}$ iff $\mathsf{y} = (\mathsf{y}_1 \cdot \ldots (\mathsf{y}_m \cdot \mathsf{x}))$	for $\mathsf{y} \in D^{m+n}$, $\mathsf{x} \in D^n$

DEFINITION 6 (UC_2 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 (i) '$X \doteq Y$' for 'X is Y, if Y is defined, else X is undefined', (ii) '$\mathsf{c}\llbracket X \rrbracket$' for '$\llbracket X \rrbracket(\mathsf{c})$', for any $\mathsf{c} \in D_{st}$ (iii) '$X[Y/Z]$' for the result of replacing every occurrence of Y in X with Z, and (iv) use the Von Neumann definition, so $0 = \varnothing$ and $1 = \{\varnothing\}$):

i.	$\llbracket u \rrbracket^g = g(u)$			if $u \in {}^{\top}Var_a \cup {}^{\bot}Var_a$
	$\llbracket A \rrbracket^g = \llbracket A \rrbracket$			if $A \in Con_a$
ii.	$\llbracket \lambda u_a(B) \rrbracket^g(\mathsf{d}) \doteq \llbracket B \rrbracket^{g[u/\mathsf{d}]}$			if $\mathsf{d} \in D_a$
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.	$\llbracket \forall u_a A \rrbracket^g$	$\doteq$	$\bigcap_{\mathsf{d} \in D_a} \llbracket A \rrbracket^{g[u/\mathsf{d}]}$	
	$\llbracket \exists u_a A \rrbracket^g$	$\doteq$	$\bigcup_{\mathsf{d} \in D_a} \llbracket A \rrbracket^{g[u/\mathsf{d}]}$	
vi.	$\llbracket A = B \rrbracket^g$	$=$	$\lvert \{\langle \mathsf{d}, \mathsf{d}' \rangle \in D_a^{\,2} \mid \mathsf{d} = \llbracket A \rrbracket^g \wedge \mathsf{d}' = \llbracket B \rrbracket^g \wedge \mathsf{d} = \mathsf{d}'\} \rvert$	
vii.	$\llbracket u_a \cdot B_s \rrbracket^g$	$\doteq$	$\langle (g(u_a) \cdot \top\llbracket B \rrbracket^g), \bot\llbracket B \rrbracket^g \rangle$	if $u_a \in {}^{\top}Var_a$
		$\doteq$	$\langle \top\llbracket B \rrbracket^g, (g(u_a) \cdot \bot\llbracket B \rrbracket^g) \rangle$	if $u_a \in {}^{\bot}Var_a$
viii.	$\llbracket \top a_n \rrbracket^g(\mathsf{i})$	$\doteq$	$((\top\mathsf{i})_a)_n$	if $\mathsf{i} \in D_s$
	$\llbracket \bot a_n \rrbracket^g(\mathsf{i})$	$\doteq$	$((\bot\mathsf{i})_a)_n$	
ix.	$\llbracket A\{B\} \rrbracket^g$	$\doteq$	${}^{\chi}\{\llbracket A \rrbracket^g(\mathsf{i}) \mid \mathsf{i} \in {}^{\{\}}\llbracket B \rrbracket^g\}$	
x.	$\mathsf{c}\llbracket \downarrow A \rrbracket^g$	$\doteq$	${}^{\chi}\{\mathsf{i} \in {}^{\{\}}\mathsf{c} \mid \exists \mathsf{j}: \top\mathsf{j} \cdot\!\geq \top\mathsf{i} \wedge \bot\mathsf{j} \cdot\!\geq \bot\mathsf{i} \wedge \mathsf{j} \in {}^{\{\}}(\mathsf{c}\llbracket A \rrbracket^g)\}$	
	$\mathsf{c}\llbracket A; B \rrbracket^g$	$\doteq$	$\mathsf{c}\llbracket A \rrbracket^g \llbracket B \rrbracket^g$	
	$\mathsf{c}\llbracket A^{\top}; B \rrbracket^g$	$\doteq$	$\{\mathsf{l} \in \mathsf{c}\llbracket A; B \rrbracket^g \mid \forall \mathsf{k} \in \mathsf{c}\llbracket A; B \rrbracket^g \exists \mathsf{j} \in \mathsf{c}\llbracket A \rrbracket^g \exists \mathsf{i} \in \mathsf{c} \exists \mathsf{d} \in D_e$: $\top\mathsf{k} \cdot\!\geq \top\mathsf{j} \cdot\!> \top\mathsf{i} \wedge (\top\mathsf{j})_1 = \mathsf{d} \wedge \llbracket B \rrbracket^g \neq \llbracket B[\top_1/\bot_1] \rrbracket^g \wedge (\top\mathsf{j})_1 = \mathsf{d}\}$	
	$\mathsf{c}\llbracket A^{\bot}; B \rrbracket^g$	$\doteq$	$\{\mathsf{l} \in \mathsf{c}\llbracket A; B \rrbracket^g \mid \forall \mathsf{k} \in \mathsf{c}\llbracket A; B \rrbracket^g \exists \mathsf{j} \in \mathsf{c}\llbracket A \rrbracket^g \exists \mathsf{i} \in \mathsf{c} \exists \mathsf{d} \in D_e$: $\bot\mathsf{k} \cdot\!\geq \bot\mathsf{j} \cdot\!> \bot\mathsf{i} \wedge (\bot\mathsf{j})_1 = \mathsf{d} \wedge \llbracket B \rrbracket^g \neq \llbracket B[\bot_1/\top_1] \rrbracket^g \wedge (\bot\mathsf{j})_1 = \mathsf{d}\}$	
xi.	$\llbracket A \subseteq B \rrbracket^g$	$\doteq$	$\lvert \{\langle \mathsf{e}, \mathsf{e}' \rangle \in D_\varepsilon^{\,2} \mid \mathsf{e} = \llbracket A \rrbracket^g \wedge \mathsf{e}' = \llbracket B \rrbracket^g \wedge \mathsf{e} \subseteq_\varepsilon \mathsf{e}'\} \rvert$	
xii.	$\llbracket BA \rrbracket^g$	$\doteq$	$\llbracket B \rrbracket(\llbracket A \rrbracket^g)$	

DEFINITION 7 (UC_2 defaults). For any UC_2 model $\langle \{D_a \mid a \in \Theta\}, \subseteq_\varepsilon, \mathsf{e}_0, \llbracket \cdot \rrbracket \rangle$, the *speech event*, e_0, induces the *default infotention state* $\mathsf{c}_0 = {}^{\chi}\{\langle \langle \mathsf{e}_0 \rangle, \langle\, \rangle \rangle\}$.

DEFINITION 8 (Truth) An $(st)st$ term K is *true* in M iff $\forall g$: $\mathsf{c}_0\llbracket K \rrbracket^g \neq \varnothing$

- Table 1 (UC_2 variables)

	$a \in \Theta$	Abbrev.	${}^{\top}Var_a$	${}^{\bot}Var_a$	Name of objects
i.	δ		$\mathbf{x}, \mathbf{y}$	x, y, z	individuals
	ε		$\mathbf{e}$	e	eventualities
ii.	s			i, j	$\top\bot$-lists
	st			I, J	infotention states
	$(st)st$	[]		K	updates
iii.	$s\delta$	D		$\underline{x}, \underline{y}, \underline{z}$	δ-projections
	$s\varepsilon$	E		$\underline{e}$	ε-projections
	[][]	$[]^2$		$\underline{J}$	dynamic []-operators

- Table 2 (drt notation)

	Abbrev.	for	UC term	Example
i.	Static relations			
	$A_a \neq B_a$	for	$\neg(A = B)$	$\top_1 i \neq x$
	$A_a \in B_{at}$	for	BA	$\bot_2 j \in \bot_1\{I\}$
ii.	Local projections ($a \in \{\delta, \varepsilon\}$, $\mathbf{R} \in \{=, \neq, \subseteq\}$)			
	$\top a, \bot a$	for	$\top a_1, \bot a_1$	$\top\varepsilon, \bot\delta$
	$A_a{}^\circ$	for	$\lambda i.\ A$	$\mathbf{x}^\circ, x^\circ$
	$A_{sa}{}^\circ$	for	$\lambda i.\ Ai$	$\top\varepsilon^\circ, \bot\delta^\circ$
	$(B_{ab}\, A_{sa})^\circ$	for	$\lambda i.\ B\, A^\circ i$	$(\text{CTR}\ \top\varepsilon)^\circ$
	$A\, \mathbf{R}_i\, B$	for	$\lambda i.\ A^\circ i\, \mathbf{R}\, B^\circ i$	$(e \subseteq_i \bot\varepsilon)$
	$B\langle A_1, \ldots A_n \rangle$	for	$\lambda i.\ B\, A_1{}^\circ i \ldots A_n{}^\circ i$	$see\langle y, \bot\delta \rangle$
	$\sim K$	for	$\lambda i.\ \neg\exists j(j \in \downarrow K\, \lambda k(k = i))$	$\sim[y \mid man\langle y \rangle]$
	(C_1, C_2)	for	$\lambda i.\ C_1 i \wedge C_2 i$	
iii.	Local drt-boxes			
	$[u]$	for	$\lambda Ij.\ \exists u \exists i(j = (u \cdot i) \wedge Ii)$	$[\mathbf{x}]$
	$[C]$	for	$\lambda Ij.\ Ij \wedge Cj$	$[man\ \bot\delta]$
	$[u \mid C]$	for	$\lambda Ij.\ \exists u \exists i(j = (u \cdot i) \wedge Ii \wedge Ci)$	$[y \mid man\langle y \rangle]$
	$[u\ u\!\upharpoonleft C]$	for	$\lambda Ij.\ \exists u \exists u\, \exists i(j = (u \cdot (u' \cdot i)) \wedge Ii \wedge Ci)$	
iv.	Global drt-boxes ($a \in \{\delta, \varepsilon\}$)			
	$[A \in B \Vert]$	for	$\lambda Ij.\ Ij \wedge Aj \in B\{I\})$	$[\bot\delta_2 \in \bot\delta \Vert]$
	$[B\{A, A\!\upharpoonleft\!\Vert\}]$	for	$\lambda Ij.\ B\, Aj\, A'\{I\}$	$[big\{\bot\delta, \bot\delta \Vert\}]$

3. ENGLISH AND KALAALLISUT IN CCG+UC$_2$

CCG-RULES (universal):

• application

X/Y: B_{ab}	Y: A_a	$\Rightarrow_{>}$	X: BA
Y: A_a	$X\backslash Y$: B_{ab}	$\Rightarrow_{<}$	X: BA

• composition

X/Y: B_{bc}	Y/Z: A_{ab}	$\Rightarrow_{>\mathbf{B}}$	X/Z: $\lambda u_a.\ B(Au)$
$Y\backslash Z$: A_{ab}	$X\backslash Y$: B_{bc}	$\Rightarrow_{<\mathbf{B}}$	$X\backslash Z$: $\lambda u_a.\ B(Au)$
Y/Z: A_{ab}	$X\backslash Y$: B_{bc}	$\Rightarrow_{<\mathbf{B_\times}}$	X/Z: $\lambda u_a.\ B(Au)$
$Y\backslash Z\backslash Z'$: $A_{aa'b}$	$X\backslash Y$: B_{bc}	$\Rightarrow_{<<\mathbf{B}}$	$X\backslash Z\backslash Z'$: $\lambda u_a \lambda u_{a'}{}'.\ B(Auu')$

TYPE ABBREVIATIONS:

$abc = a(bc)$, $[a_1 \ldots a_n] = a_1 \ldots a_n[]$

English fragment:

E1 (English categories)

i. S, PN, IV, AP, NP, CN are English categories;

ii. If X and Y are English categories, then so are X/Y and $X\backslash Y$

CAT ABBREVIATIONS: TV = IV/PN′, VP = S\PN, QP = S/VP, QP′ = IV\TV, PP = VP\VP

E2 (English category-to-type rule)

i. $\mathbf{tp}(\text{S}) = []$, $\mathbf{tp}(\text{PN}) = \text{D}$, $\mathbf{tp}(\text{IV}) = []$, $\mathbf{tp}(\text{AP}) = [\text{E}]$, $\mathbf{tp}(\text{NP}) = [\text{D}]$, $\mathbf{tp}(\text{CN}) = \delta t$

ii. $\mathbf{tp}(X/Y) = \mathbf{tp}(X\backslash Y) = \mathbf{tp}(Y)\mathbf{tp}(X)$

Table 3

English item	Category	UC$_2$ type a	Notes
busy, …	AP	[E]	$\underline{A} \in {}^{\perp}Var_{[\text{E}]}$
see-, *get-*, *give-*,…	TV	[D]	$\underline{P} \in {}^{\perp}Var_{[\text{D}]}$
have-	IV/IV$_{\text{pf}}$	[][]	$K \in {}^{\perp}Var_{[]}$
be-	IV/XP	$\mathbf{tp}$(XP)[]	XP $\in$ {AP, NP, IV$_{\text{ps}}$}
Ole, *Ann*,…	NP	[D]	$\underline{x}, \underline{y}, \underline{z} \in {}^{\perp}Var_{\text{D}}$
bear, *book*, …	CN	δt	$\underline{e} \in {}^{\perp}Var_{\text{E}}$
one, *A*, *THE*…	NP/CN	(δt)[D]	$P \in {}^{\perp}Var_{\delta t}$
?-	QP$^?$/NP	[D][[D]]	$^? \in \{\text{-}, \text{-}', \text{-}''\}$
BY, *TO*	PP/NP	[D][[D]D]	
I, *U*, *HE*, …	PN	D	
ME, *U*, *HM*, …	PN′	D	
-PS (passive prt)	IV$_{\text{ps}}$\TV	[D][]	
-PF (perfect prt)	IV$_{\text{pf}}$\IV	[][]	
-TNS	VP\IV	[][D]	
=N'T	VP\VP	[D][D]	

ENGLISH LEXICON (sample):

• lexical categories (TV = IV/PN′)

busy	AP: $\lambda \underline{e}[busy\langle \underline{e}, \text{CTR } \underline{e}\rangle]$
see-	TV: $\lambda \underline{y}([e]^{\perp}; [see\langle \perp\varepsilon, \text{CTR } \perp\varepsilon, \underline{y}\rangle])$
give-	TV: $\lambda \underline{y}([e]^{\perp}; [give\langle \perp\varepsilon, \text{CTR } \perp\varepsilon, \underline{y}\rangle])$
have-	IV/IV$_{\text{pf}}$: $\lambda K.\ K$
be-	IV/AP: $\lambda \underline{A}([e]^{\perp}; \underline{A} \perp\varepsilon)$
	IV/NP: $\lambda \underline{P}([e]^{\perp}; \underline{P}\ \text{CTR}\langle \perp\varepsilon\rangle)$
	IV/IV$_{\text{ps}}$: $\lambda K(K^{\perp}; [e \mid e \subseteq_i \perp\varepsilon, \text{CTR } e =_i \text{BCK } \perp\varepsilon])$
Ole	NP: $\lambda \underline{x}[\underline{x} =_i ole]$
bear	CN: $\lambda x.\ bear\ x$
one	NP/CN: $\lambda P \lambda \underline{x}([P\langle ?\delta\rangle]; [\underline{x} \in ?\delta \|\,\|])$

• grammatical categories (VP = S\PN, QP = S/VP, QP′ = IV\TV, PP = VP\VP)

A	NP/CN: $\lambda P \lambda \underline{x}[P\langle \underline{x}\rangle]$	
THE	NP/CN: $\lambda P \lambda \underline{x}[P\langle ?\delta\rangle, \underline{x} =_i ?\delta]$	
SU-	QP/NP: $\lambda \underline{P}' \lambda \underline{P}((([\mathbf{x}]^{\top}; \underline{P}' \top\delta)^{\top}; \underline{P} \top\delta)$	
DO-	QP′/NP: $\lambda \underline{P}' \lambda \underline{P}((([y]^{\perp}; \underline{P}' \perp\delta)^{\perp}; \underline{P} \perp\delta)$	
BY	PP/NP: $\lambda \underline{P}' \lambda \underline{P} \lambda \underline{x}(\underline{P}\ \underline{x}^{\perp}; \underline{P}'\ \text{CTR}\langle \perp\varepsilon_2\rangle)$	
TO	PP/NP: $\lambda \underline{P}' \lambda \underline{P} \lambda \underline{x}(\underline{P}\ \underline{x}^{\perp}; \underline{P}'\ \text{DAT}\langle \perp\varepsilon\rangle)$	
I, *U*, *HE*, …	PN: $\text{CTR}\langle \top\varepsilon\rangle, \text{DAT}\langle \top\varepsilon\rangle, ?\delta$	$(?\delta \in \{\top\delta, \perp\delta, \top\delta_2\})$
ME, *U*, *HM*, …	PN′: $\text{CTR}\langle \top\varepsilon\rangle, \text{DAT}\langle \top\varepsilon\rangle, ?\delta, \top\delta$	$(?\delta \in \{\perp\delta, \top\delta_2\})$
-PS	IV$_{\text{ps}}$\TV: $\lambda \underline{P}.\ \underline{P}\ \text{BCK}\langle \perp\varepsilon\rangle$	
-PF	IV$_{\text{pf}}$\IV: $\lambda K.\ K$	
-TNS	VP\IV: $\lambda K \lambda \underline{x}(K^{\perp}; [\text{CTR } \perp\varepsilon =_i \underline{x}])$	
=N'T	VP\VP: $\lambda \underline{P} \lambda \underline{x}[\sim(\underline{P}\ \underline{x})]$	

Kalaallisut fragment:

K1 (Kalaallisut categories)

i. s, pn, cn, are Kalaallisut categories;

ii. If X and Y are Kalaallisut categories, then so are X/Y and $X\backslash Y$

ABBREVIATIONS: iv = s\pn, tv = iv\pn, s$^+$ = s/s

K2 (Kalaallisut category-to-type rule)

i. $\mathbf{tp}(\text{s}) = []$, $\mathbf{tp}(\text{pn}) = \text{D}$, $\mathbf{tp}(\text{cn}) = [\text{D}]$

ii. $\mathbf{tp}(X/Y) = \mathbf{tp}(X\backslash Y) = \mathbf{tp}(Y)\mathbf{tp}(X)$

Table 4

Kalaallisut item (gloss)	Category	UC_2 type *a*	Notes
busy-, …	iv	[D]	$\underline{x}, \underline{y}, \underline{z} \in {}^{\perp}Var_{\mathrm{D}}$
see-, get-, give-…	tv	[DD]	$\underline{R} \in {}^{\perp}Var_{[\mathrm{DD}]}$
Ole-, bear-, one-…	cn	[D]	$\underline{P} \in {}^{\perp}Var_{[\mathrm{D}]}$
-pssv, -antip	iv\tv	[DD][D]	
-not	iv\iv	[D][D]	
-DEC, …	s\pn\iv	[D](D[])	$K \in {}^{\perp}Var_{[]}$
$\text{-(ERG)}^{\top}$, $\text{-}(\cdot)^{\perp}$, -MOD	s^{+}\cn	$[\mathrm{D}][]^{2}$	
-1S, -2S, $\text{-3S}_{(\top)}$, $\text{-3S}_{(\perp)}$, …	x\(x\pn)	(D…)…	x ∈ {s, s⁺, cn, …}
$\text{-}^{\backslash}(\cdot)$ (head x lift)	$x\backslash s^{+}\backslash x$	$[\mathrm{D}][]^{2}[\mathrm{D}]$	x ∈ {iv, cn}
$\text{-}^{\backslash\backslash}(\cdot)$ (pre-head lift)	$s^{+}\backslash s^{+}\backslash s^{+}$	$[]^{2}[]^{2}[]^{2}$	$\underline{J} \in {}^{\perp}Var_{[]2}$

KALAALLISUT LEXICON (sample):

• lexical categories

busy-   iv: $\lambda\underline{x}([e]^{\perp}; [busy\langle\perp\varepsilon, \underline{x}\rangle])$ *ulapig-*

see-   tv: $\lambda\underline{y}\lambda\underline{x}([e]^{\perp}; [see\langle\perp\varepsilon, \underline{x}, \underline{y}\rangle])$ *taku-*

give-   tv: $\lambda\underline{y}\lambda\underline{x}([e]^{\perp}; [give\langle\perp\varepsilon, \underline{x}, \underline{y}\rangle])$ *tuniut-*

Ole-   cn: $\lambda\underline{x}[\underline{x} =_i ole]$ *Ole-*

bear-   cn: $\lambda\underline{x}[bear\langle\underline{x}\rangle]$ *nanu(q)-*

one-   cn: $\lambda\underline{x}([?\delta \in \underline{x}||]; [\underline{x} \in ?\delta||])$ *ataasi(q)-*

-pssv   iv\tv: $\lambda\underline{R}\lambda\underline{z}.\ \underline{R}\ \underline{z}\ \mathrm{CTR}\langle\perp\varepsilon\rangle$ *-niqar|…*

-antip   iv\tv: $\lambda\underline{R}\lambda\underline{z}.\ \underline{R}\ \mathrm{BCK}\langle\perp\varepsilon\rangle\ \underline{z}$ *-si|…*

-not   iv\iv: $\lambda\underline{P}\lambda\underline{x}.[\sim(\underline{P}\ \underline{x})]$ *-nngit*

• grammatical categories

-DEC   s\pn\iv: $\lambda\underline{P}\lambda\underline{x}.\ \underline{P}\ \underline{x}$ *-pu|pa|la*

$\text{-(ERG)}^{\top}$ s^{+}\cn: $\lambda\underline{P}\,\lambda K.\ ([\mathbf{x}]^{\top}; \underline{P}\top\delta)^{\top}; K$ *-Ø|p|…|…(-3$_{\top}$)*

s^{+}\cn: $\lambda\underline{P}\,\lambda K.\ (\underline{P}\top\delta; K)$

$\text{-(ERG)}^{\perp}$ s^{+}\cn: $\lambda\underline{P}\,\lambda K.\ ([y]^{\perp}; \underline{P}\perp\delta)^{\perp}; K$ *-Ø|p|…|…(-3$_{\perp}$)*

s^{+}\cn: $\lambda\underline{P}\,\lambda K.\ (\underline{P}\perp\delta^{\perp}; K)$

-MOD s^{+}\cn: $\lambda\underline{P}\lambda K.\ (K^{\perp}; \underline{P}\ \mathrm{BCK}\langle\perp\varepsilon\rangle)$ *-mik*

-ABL s^{+}\cn: $\lambda\underline{P}\lambda K.\ (K^{\perp}; \underline{P}\ \mathrm{CTR}\langle\perp\varepsilon\rangle)$ *-mit*

-1S   s\(s\pn): $\lambda\underline{P}.\ \underline{P}\ \mathrm{CTR}\langle\top\varepsilon\rangle$ *-nga|…*

-2S   s\(s\pn): $\lambda\underline{P}.\ \underline{P}\ \mathrm{DAT}\langle\top\varepsilon\rangle$ *-tit|…*

$\text{-3S}_{(\top)}$ s\(s\pn): $\lambda\underline{P}.\ \underline{P}\top\delta$ *-q|a…*

$\text{-3S}_{(\perp)}$ s\(s\pn): $\lambda\underline{P}.\ \underline{P}\perp\delta$ *-Ø…*

• lexical operators

$\text{-}^{\backslash}(\cdot)$ $iv\backslash s^{+}\backslash iv$: $\lambda\underline{P}\lambda\underline{J}\lambda\underline{x}.\ \underline{J}(\underline{P}\ \underline{x})$ head lift

$\text{-}^{\backslash\backslash}(\cdot)$ $s^{+}\backslash s^{+}\backslash s^{+}$: $\lambda\underline{J}'\lambda\underline{J}\lambda K.\ \underline{J}(\underline{J}'K)$ pre-head lift