Deriving the Functional Hierarchy

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1 Introduction

1.1 The problem

(1) The **Minimalist Program** strives to go beyond "explanatory adequacy" (an explanation of how language can be learned) to develop a plausible account for how human linguistic ability could have evolved (Chomsky 2005 inter alia). In this context it is conjectured that UG is sparse and minimal. Phase heads (e.g. C, and v) are the locus of important features driving derivations, and non-phase heads (e.g. T and V) are necessary for their operation. Anything else is, according to one interpretation of the Minimalist Program, unlikely to be due to UG, but must instead be due to external factors (e.g. 'general cognition').

(2) The **Cartographic** enterprise, on the other hand, proposes to map the actually occurring functional heads in the world's languages, discovering extraordinarily rich structures in every extended projection, in every language (Cinque 1999). The impressive uniformity (variation seems to be largely restricted to the inventory of features, not their hierarchy) leads to the conclusion that the hierarchy must be based on innate factors. The hierarchy is furthermore restricted to a specific subdomain of cognition (e.g. diminutives, not 'dangerous things'), which suggests that it is part of UG.

1.2   Why it matters

(3)   **Why Minimalism needs Cartography.** Minimalists ignore the cartographic enterprise at their peril. It is common practice for minimalist work to posit an occasional Voice or Applicative or Focus head as needed, and to continue to assume that the sparse C-T-v-V architecture is sufficient, with minor modifications.

> Chomsky (2008:9): "C is shorthand for the region that Rizzi (1997) calls the "left periphery," possibly involving feature spread from fewer functional heads (maybe only one), ..."

But in a theory based on Minimalist principles, the flapping of butterfly wings in one place can cause a typhoon in another: When mechanisms are pared down to a minimum, each has tremendous consequences. Therefore it is vital to know what mechanisms regulate the combinations of heads beyond the phase-non-phase pairs C-T and v-V. How are features arranged at the edge? Are they contained in one or several heads? Does this arrangement bear on the order of operations? What are the properties of nonphase heads? And so on.

(4)   **Why Cartography needs Minimalism.** Linguistic theory cannot rest on its maps. Cartography is in desperate need of a theory of the functional hierarchy. Although the data is quite rich, it seriously undetermines the possible analyses. Are there categories which are ordered and others which are not (e.g. negation, agreement)? For those which are ordered, is there a total order or only a partial order? Can categories be missing from the middle of a sequence, or are they always present in some guise? What is the relationship among functional hierarchies in distinct extended projections? These questions cannot be answered by simple examination of the data, and require a theory.

1.3   The solution

(5)   We adopt (as working hypothesis) the Minimalist conjecture that a fine-grained hierarchy of functional heads cannot be part of UG; that is, it cannot be innate and specific to language.

(6)   We are persuaded that Cartographic work shows that there are fine-grained hierarchies of functional heads in each language, and that they are similar to each other (i.e. the clausal hierarchy of English is similar to those of Japanese, Navajo, Kîîtharaka, etc.)

(7)   We conclude that these hierarchies emerge in some highly constrained way. In this paper we offer a proposed account of how this happens.

(8)   Our approach is three-pronged.

    a.   We adopt a fundamental triparition of the clause into a V-domain, a T-domain, and a C-domain (Platzack 2000; 2010) and provide this with a formal semantic grounding on a conceptual backdrop; we take events (e), situations (s), and propositions (p) to be conceptual primitives recruited by the language faculty, and we take the hierarchy of C > T > V to follow from the interaction of (i) the way these conceptual primitives are organized in the wetware and (ii) the way they are harnessed by the syntactico-semantic system

    b.   We undertake a closer look at putative cases of strict hierarchy within languages which do not follow from the arrangement of s, e, and p. We find that in some cases, the hierarchy is not fixed, and in some cases, there are independent factors explaining the hierarchy

    c.   Finally, we are left with a residue: Strict hierarchy which does not follow from the e-s-p triparition, nor from independent factors. For these cases we posit selectional restrictions, which are necessarily language specific. Therefore these cases are predicted to involve points of crosslinguistic variation, and we argue that they do.

(9)   In this presentation, we apply this theory to the English clause, deriving the classic auxiliary ordering which was treated in Chomsky (1957).

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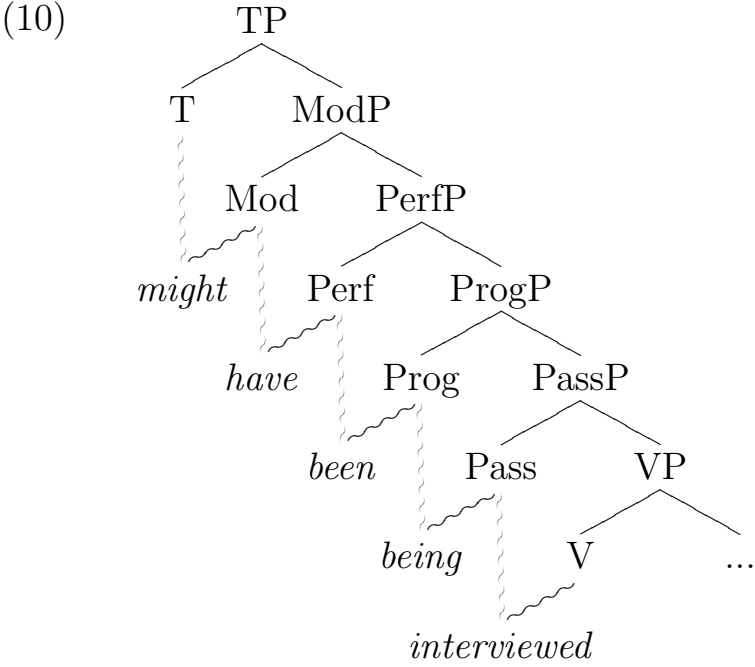
2   Sortal domains as conceptual underpinnings of hierarchy

(11)   **Events**. There are compelling reasons to recognize EVENTS in semantic representations (Davidson 1967), for example they can be quantified over (*John knocked twice*).

(12)   Characteristics of events (or eventualities)

   a.   People have consistent intuitions about what percepts constitute a single event; an instance of a potentially distinct event-type may be a SUBEVENT in a larger event
   b.   Causation and resultativity are relations among subevents; possibly they are both specific instances of a more general 'leads to' relation (Ramchand 2008)
   c.   Thematic roles are relations between individuals and events
   d.   Stativity and dynamicity are possible properties of events or subevents

(13)   The syntactician's name for an event description is VP.

   $\lambda e.VP(e)$

(14)   **Situations**. Situation semantics (Barwise and Perry 1983, Kratzer 1989, inter alios) originally emerged as an alternative to possible world semantics. Situations are partial specifications of states of affairs. We distinguish them from Davidsonian events.

(15)   Characteristics of situations

   a.   Situations are elaborations of eventualities (hence they presuppose the existence of an eventuality, so the eventuality is existentially closed)
   b.   Situations have a TIME parameter, unlike events (Giorgi and Pianesi 1997)
   c.   Situations can also be related to particular possible worlds (Austinian topic situations)
   d.   Situations can have topics (the case where the Austinian topic situation is based on an individual, or a description of an individual)

(16)   TPs are situation descriptions

   $\lambda s.TP(s)$

(17)   It is important to the workings of the system that events are not visible to operators in the TP domain. We ensure this by existentially closing

4

the event when it is embedded in a situation. In fact, we believe this is part of a general principle of semantic compositionality and posit it as a principle of Compositional Coherence
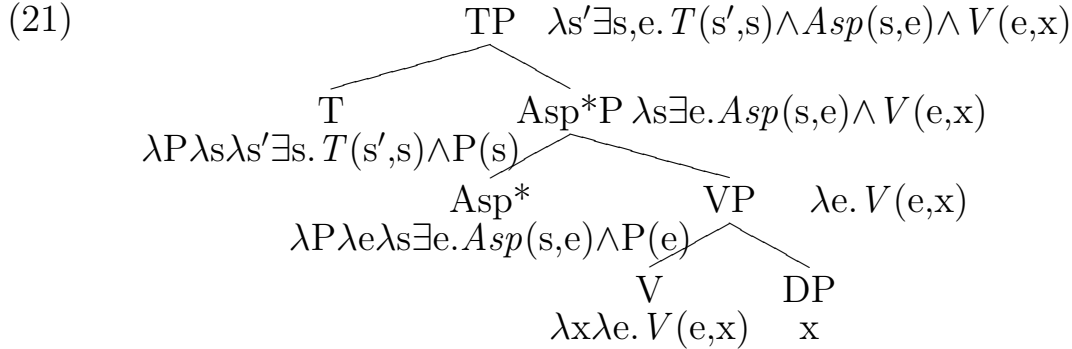
> **Compositional Coherence**: If X embeds YP, then XP is a description of a state of affairs that is a monotonically coherent elaboration of the state of affairs described by YP.

(18) Reichenbachian tense-aspect semantics allows for a decomposition of complex tenses into a tense relation and an aspectual relation (Reichenbach 1947, Klein 1994, Giorgi and Pianesi 1997, Demirdache and Uribe-Etxebarria 2000).
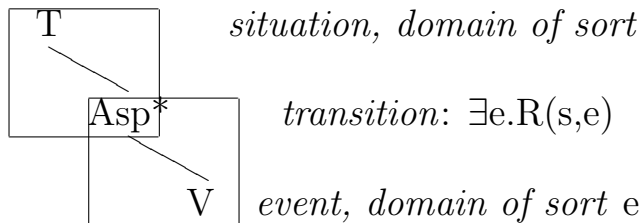
RELATION 1 (tense):		RELATION 2 (aspect):	
$S \prec R$	future	$R \prec E$	prospective
$S \succ R$	past	$R \succ S$	perfect
$S = R$	present	$R = E$	neutral

(19) We assume that the locus of Relation 2 in the above table is an aspectual head, Asp*, while the locus of Relation 1 is the tense head, T (cf. Klein 1994, Demirdache and Uribe-Etxebarria 2000). We furthermore assume that at the transition point Asp*, the event sort is converted to a situation (formally, it is related to a situation and existentially closed).

(20) There may be different kinds of Asp[ect]. Thus we call the semantic functor which relates events to situations Asp*

(21)
$$\text{TP} \quad \lambda s' \exists s,e.\, T(s',s) \wedge Asp(s,e) \wedge V(e,x)$$

$$\text{T} \qquad \text{Asp*P} \ \lambda s \exists e.\, Asp(s,e) \wedge V(e,x)$$
$$\lambda P \lambda s \lambda s' \exists s.\, T(s',s) \wedge P(s)$$

$$\text{Asp*} \qquad\qquad \text{VP} \quad \lambda e.\, V(e,x)$$
$$\lambda P \lambda e \lambda s \exists e.\, Asp(s,e) \wedge P(e)$$

$$\text{V} \qquad \text{DP}$$
$$\lambda x \lambda e.\, V(e,x) \qquad x$$

(22) The boxes represent the accessibility of the e and s arguments:

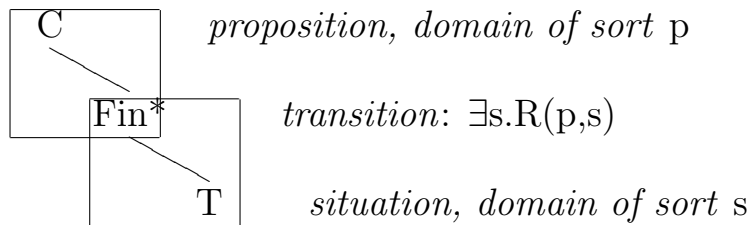| T	*situation, domain of sort* s
Asp*	*transition*: $\exists e. R(s,e)$
V	*event, domain of sort* e

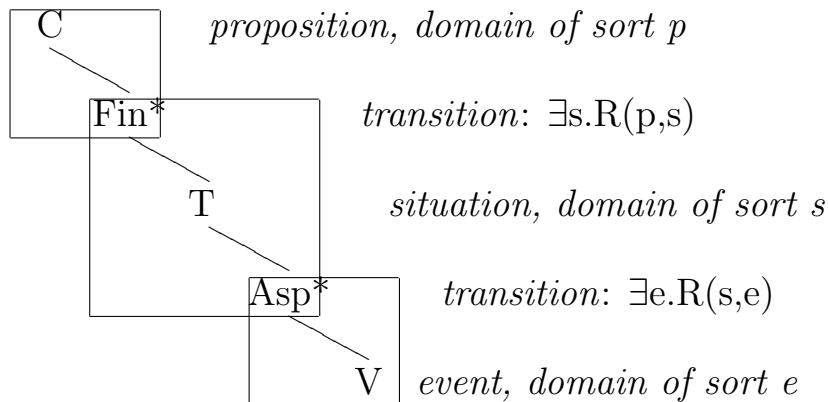(23) So for example, if an S-Adv *already* is a property of situations, then

that S-Adv can merge in the T domain, but cannot merge in the V domain, where it will have no interpretation

(24) And if a V-Adv *well* is a property of events, then that V-Adv will be interpretable in the V domain, but cannot be attached outside the existential closure of e at Asp*P.

(25) **Proposition**. Above the domain of situations, we posit another category, that of the proposition.

(26) Properties of propositions.

    a. Propositions are elaborations of situations; thus they presuppose a situation, which is existentially closed

    b. Propositions, unlike situations, are anchored to the utterance context

    c. It is only at the level of the proposition that speaker-oriented parameters come into play

(27) Boxes show the accessibility of the p and s arguments:

    C   *proposition, domain of sort* p

    Fin*   *transition:* $\exists s.R(p,s)$

    T   *situation, domain of sort* s

(28) The combination of the two box diagrams:

    C   *proposition, domain of sort p*

    Fin*   *transition:* $\exists s.R(p,s)$

    T   *situation, domain of sort s*

    Asp*   *transition:* $\exists e.R(s,e)$

    V   *event, domain of sort e*

3   Linguistic evidence for domains in the English auxiliary system

(29) The ordering of the English auxiliaries is rigid (cf. Chomsky 1957)

    {T, Mod} $\prec$ Perf $\prec$ Prog $\prec$ Pass $\prec$ V

a. This order should have been being explained.
b. *John is having returned.
c. *Whenever I see you, you're always just having returned from a vacation. (Schachter 1983)
d. *John is being hunting.
e. *John seems to have had already eaten.

3.1 Progressive and the boundary between events and situations

3.1.1 Expletive associates

(30) There is only one position in the sequence for an expletive associate, between Perf *-en* and Prog *-ing* (cf. Harwood 2011)

    a. *There could have been being <u>a truck</u> loaded.
    b. There could have been <u>a truck</u> being loaded.
    c. *There could have <u>a truck</u> been being loaded.
    d. *There could <u>a truck</u> have been being loaded.
    e. *There <u>a truck</u> could have been being loaded.
    f. <u>A truck</u> could have been being loaded.

(31) This boundary is not dependent on Prog *-ing* being present

    a. There could have been <u>a truck</u> loaded.
    b. *There could have <u>a truck</u> been loaded.
    c. *There could <u>a truck</u> have been loaded.
    d. <u>A truck</u> could have been loaded.

(32) Nor is it dependent on Perf *-en*

    a. *There could be being <u>a truck</u> loaded.
    b. There could be <u>a truck</u> being loaded.
    c. *There could <u>a truck</u> be being loaded.
    d. <u>A truck</u> could be being loaded.

3.1.2 VP fronting and pseudoclefts

(33) Similarly, VP fronting and specificational pseudoclefts pick out a constituent between Perf *-en* and Prog *-ing* (cf. Sailor 2012)

    If Mary says that the cakes will have been being eaten, then …
    a. *…   [eaten], they will have been being.
    b. …   [being eaten], they will have been.

c. *...   [been being eaten], they will have.

d. *...[have been being eaten], they will.

(34)   A: John should have been being praised. B: No, ...

a. *...   [criticized] is what he should have been being.

b. ...   [being criticized] is what he should have been.

c. *...   [been being criticized] is what he should have.

d. *...[have been being criticized] is what he should.

(35)   Again, this is not dependent on the presence of Progressive *-ing*

If Mary says that the cakes will have been eaten, then ...

a. ...   [eaten], they will have been.

b. *...   [been eaten], they will have.

c. *...[have been eaten], they will.

(36)   Nor on the presence of Perfect *-en*

If Mary says that the cakes will be being eaten, then ...

a. *...   [eaten], they will be being.

b. ...   [being eaten], they will be.

c. *...[be being eaten], they will.

(37)   These facts show that there is a privileged boundary at the point between Perfect *-en* and Progressive *-ing* which is not dependent on the surface presence of any specific aspectual feature or morphological exponent. We take the boundary to be at Asp*.

3.1.3 British nonfinite *do*-substitution

(38)   *Do* may substitute for eventive or stative verbs after an auxiliary, but cannot substitute for an auxiliary.

a.   John might leave, and Mary might do also.

b.   John might really like oysters, and Mary might do also.

c.   John might have seen the movie, and Mary might (*do) also.

d.   John might be singing a song, and Mary might (*do) also.

(39)   Not all nonfinite forms may be substituted for by *do*:

a.   John might leave, and Mary might do also.

b.   John has left, and Mary has done also.

c.   John is leaving, and Mary is (*doing) also.

d.   John was arrested, and Mary was (*done) also.

(40)   British nonfinite *do* can substitute for an infinitive modal complement or a perfect participle, but not for a progressive or passive participle;

hence it, too, motivates a cut between Perf and Prog.

(41)   Specifically, Br *do* is a pro-form for a situation-denoting projection, at least an Asp*P. The progressive, contained in VP, is too low to show up on this pro-form.

3.1.4   Selection

(42)   Independent motivation for placing the Progressive inside the VP domain is the selectional restriction that the Progressive places on the Aktionsart of the verb phrase
a.   John is dancing the tango.
b.   *John is knowing the answer.

(43)   In contrast, the Perfect does not constrain the Aktionsart of its complement, consistent with our placement of it higher up in the T domain.
a.   John has destroyed the castle. (result)
b.   John has eaten sushi. (existential)
c.   John has known Sue for three years. (universal, stative)

3.1.5   Temporal modification

(44)   The Perfect also allows separate temporal modification of the reference time and the event time, in contrast to the Progressive
a.   When I saw him, John had spoken with her the day before.
b.   *By next month, John is building a house now.

(45)   Modals also allow independent temporal parameters.
Now John may go to the party tomorrow.
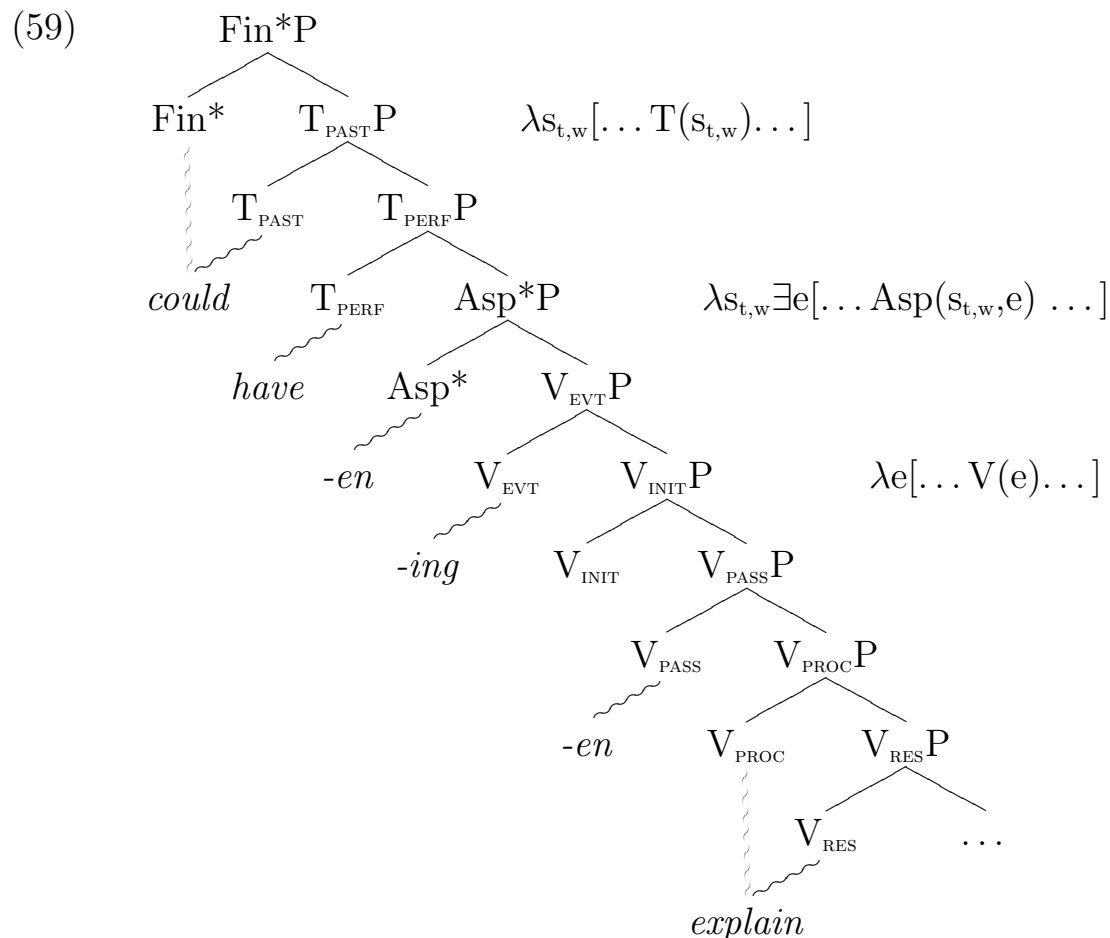
3.2   Perfect and Root Modals are in the same zone

(46)   In English, modals precede the Perfect, but they have no nonfinite forms. In languages with nonfinite modals, modals can be placed under the Perfect.

(47)   Norwegian modals showing English-like order Mod $\prec$ Perf
a.   Kari kan ha   gått på ski.
Kari can have gone on ski
'Kari might have gone skiing'

9

b. Ola må   ha   måkket.
   Ola must have shoveled
   'Ola must have shoveled snow'

(48) Norwegian modals showing the reverse order Perf ≺ Mod

a. Kari har kunnet   gå på ski til jobb hver dag.
   *Kari has could.*PTCPL *go on ski to work every day*
   'Kari has been able to ski to work every day'

b. Ola har måttet   måkke sne i hele   dag.
   *Ola has must.*PTCPL *shovel snow in whole day*
   'Ola has had to shovel snow all day'

(49) Norwegian examples of Mod ≺ Mod

a. Kari må   kunne   gå på ski.
   *Kari must could.*INF *go on ski*
   'Kari must be able to ski'

b. Ola kan måtte   måkke.
   *Ola can must.*INF *shovel*
   'Ola might have to shovel'

(50) In fact, the English modal *have to* has nonfinite forms, and behaves just like Norwegian modals

a. Ollie has   to   have   cleared   the driveway.
        MODAL INF.T PERF.AUX PARTICIPIAL V
        /ˈhæstəhəv/

b. Ollie has   had   to   clear   the driveway.
        PERF.AUX MODAL INF.T INFINITIVE V
        /həzˈhædtə/

c. Ollie might have to   clear   the driveway.
        MOD   MOD INF.T INFINITIVE V
        /ˈmaɪtˈhæftə/

d. Ollie might have   cleared   the driveway.
        MOD   PERF.AUX PARTICIPIAL V
        /ˈmaɪtəv/

(51) The standard conceptions of tense and modality take tense to be a relation between times, and modality to be a quantifier over worlds.

a. $\llbracket must\ \alpha \rrbracket^w = 1$ iff $\llbracket \alpha \rrbracket^{w'} = 1$ for all w′ that are accessible from w.
b. $\llbracket past\ \alpha \rrbracket^t = 1$ iff $\llbracket \alpha \rrbracket^{t'} = 1$ for some t′ that precedes t.

(52) But if both times and worlds are 'parameters' of situations, then both are possible in the situational zone.

3.3 Epistemic modals and tense

(53) Only circumstantial (root) modals freely order with respect to Perf. Epistemic modals are systematically higher.

    a.   Kari har kunnet   gå på ski til jobb hver dag.
          *Kari has could.*PTCPL *go on ski to work every day*
          'Kari has been able to ski to work every day' (root only; *'has possibly skied')

    b.   Ola har måttet   måkke sne i hele dag.
          *Ola has must.*PTCPL *shovel snow in whole day*
          'Ola has had to shovel snow all day' (root only; *'has apparently shoveled')

(54) Norwegian examples of Mod ≺ Mod also show this: Epist > Root, Root > Root, *Root > Epist

    a.   Kari må kunne   gå på ski.
          *Kari must could.*INF *go on ski*
          'Kari must be able to ski'

    b.   Ola kan måtte   måkke.
          *Ola can must.*INF *shovel*
          'Ola might have to shovel'

(55) Similarly with English *have to*; it has an Epistemic reading only when unembedded

    a.   John has to be in the library. (Epistemic possible)

    b.   John might have to be in the library. (No epistemic reading possible)

(56) Thus the Cinquean hierarchy Epistemic > T > Circumstantial > . . .

(57) Hacquard (2006): Epistemic modals are bound by the higher speech event, circumstantial modals are bound by a lower event at the level of aspect

(58) Ramchand (2012): Circumstantial modality involves quantification over situations with free world time variables; epistemic modality involves quantification over situations with fixed world and time variables, but free speaker oriented parameters (epistemic modality). The domain of quantification is not a lexical parameter, but is directly given by the 'sort' of the complement. Under this view, epistemic modals must combine with the phrase structural description *after* temporal and world variables are anchored, in the zone of propositions.

4 English Auxiliaries, once more

(59)

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                    Fin*P
            ┌─────────┴─────────┐
          Fin*           T_PAST P            λs_{t,w}[...T(s_{t,w})...]
           ┊          ┌──────┴──────┐
           ┊        T_PAST        T_PERF P
         could    ┌──┴──┐
                T_PERF      Asp*P            λs_{t,w}∃e[...Asp(s_{t,w},e) ...]
                 have    ┌────┴────┐
                       Asp*      V_EVT P
                      ┌─┴─┐   ┌────┴────┐
                     -en  V_EVT       V_INIT P       λe[...V(e)...]
                          ┊        ┌────┴────┐
                        -ing     V_INIT     V_PASS P
                                        ┌─────┴─────┐
                                      V_PASS       V_PROC P
                                       ┊        ┌────┴────┐
                                      -en      V_PROC    V_RES P
                                               ┊      ┌───┴───┐
                                               ┊     V_RES    ...
                                            explain
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4.1 The event zone, sort e

(60) **The event description zone**. In general, everything below Asp* is an eventuality description.

    a.   *V_proc*: This is a description of a process/dynamic event with a participant argument that UNDERGOES the process. (obligatory for dynamic verbs)

$$\lambda x \lambda e[\text{Process}(e) \ \& \ \text{Undergoer}(e,x)]$$

    b.   *V_init*: This selects for a process eventuality description to build a caused-process eventuality description. It comes with an argument that either (internally) causes, or otherwise initiates the process. (optional)

$$\lambda P \lambda y \lambda e'[\text{CausedProcess}(e', e) \ \& \ P(e) \ \& \ \text{Initiator}(e', y)]$$

    c.   *V_pass*: This head will inherit the undergoer argument from a ProcP that it combines with, but will prevent a transitive verb

from head raising up to V$_{init}$.

λPλe$'\exists$e[P(e) & Transition(e$'$, e)]

Where the Transition(e$'$, e) relation means "*e$'$ is the complex event which consists of the (causal) transition from e to not-e.*"

d. V_{evt}: The -ING morpheme is also a species of V head in that it selects for a dynamic eventuality and creates a derived eventuality description.

V_{ing}: λQλzλe$'\exists$e[Q(e) & InProgressState(e$'$,e) & Holds(e$'$,z)]

(61)   Selectional requirements here have semantic consequences.

4.2   The transition from events to situations

(62)   **Sortal Transition from Events to Situations**. We use the * diacritic to distinguish Asp* from the other heads in the system that one might want to call 'aspectual' in a pretheoretic sense. Asp* selects for an eventuality description (delivered by VP) and builds a situational description that has time and world parameters, based on it. The overarching constraint of conceptual coherence or monotonicity requires that the situational description so built include the VP event as one of its parameters. (This is the equivalent of the more traditional notion that the time variable overlap with the run time of the event.)

(63)   There are a number of different lexical items in English that have the category Asp*:

a. Asp^*_{imp}: This is the default imperfective aspect head, which bears no explicit morphology in English. It locates the reference situation, which now has world and time parameters, temporally somewhere inside the temporal trace function of the event

λPλs$\exists$e[P(e) & the temporal parameter of s is *contained in* τ(e) (the temporal trace function of e)]

b. Asp^*_{en}: This is the perfect head that is built with -EN morphology. It builds a reference situation that includes the final transition of the temporal trace of the event. Notice that the semantics is the same as the earlier -EN head, except that it manipulates a higher situation variable.

Asp^*_{en}: λPλs$\exists$e[P(e) & Transition(s, e)]

Here Transition(s, e) means *s is the situation in w* with temporal parameter t which is the temporal trace of e to not-e.*

13

4.3   The situation zone, sort s

(64)   **The Situational Description Zone**. T heads select for situational descriptions and deliver an updated or derived situational description. There are a number of lexical items in our system that have the syntactic category label T:

    a. T_{perf}: This is the perfect auxiliary, which selects for a situation and then builds a complex derived stative situation based on it, which is related to a notional 'holder'. This is most similar to the Parsons account in terms of resultant states, but differs from it in involving temporally specified situations instead of pure events.

        $\lambda Q \lambda x \lambda s' \exists s[Q(s)$ & s' is a stative situation that begins as a consequence of s, where s is some transitional situation & Holder(s', x)]

    b.   The above denotation will require perfect *have* to combine with an -EN-P, presumably of the Asp* variety, but we also think there is an attachment site for -EN in the T domain as well, and so we give the denotation for it here:

        T_{en}: $\lambda P \lambda s' \exists s[P(e)$ & Transition(s', s)]

        Here, Transition(s', s) means *s' is the situation in w* with temporal parameter t which is the temporal trace of s followed by not-s*

    c. T_{modal}: We give a very general schematic for the denotation of modality here, following Kratzer (2008). The situational description the modal combines with is claimed to be accessible with a certain probability from the anchor situation introduced by the modal. The different modals will of course come specified with different Accessibility relations (Acc) and quantificational force.

        $\lambda Q \lambda s' \exists s[Q(s)$ & Acc(s')(s)]

4.4   The transition from situations to propositions

(65)   **Sortal Transition from Situations to Propositions**. Fin* combines with a situational description to create a proposition by binding off s, anchoring it (expressing a relationship to) the utterance situation (s*, the Kaplanian context). *In English*, modals carry anchoring information (it is just that they anchor via the world parameter, rather than the temporal parameter). In the world domain non-equality of the world parameter is irrealis; in the temporal domain it is past (cf. also Iatridou 2000):

a. Fin*$_{pres}$: $\lambda R \lambda p[\ p = \text{Assertion}(\exists s[R(s)\ \&\ s_t = s^*{}_t])]$
b. Fin*$_{past}$: $\lambda R \lambda p[\ p = \text{Assertion}(\exists s[R(s)\ \&\ s_t \neq s^*{}_t])]$
c. Fin*$_{realis}$: $\lambda P \lambda s \lambda p[p = \text{Assertion}(\exists s[R(s)\ \&\ s_w = s^*{}_w])]$
d. Fin*$_{irrealis}$: $\lambda P \lambda s \lambda p[p = \text{Assertion}(\exists s[R(s)\ \&\ s_w \neq s^*{}_w])]$

4.5 The propositional zone, sort p

(66) **The Propositional Zone**: We will assume that the proposition is a relationship between a situation and an assertor and contains information about the speaker and speaker attitude as well as encoding of familiarity and novelty of the information to the members of the utterance situation (participants in the speech act.) Evidentials and Epistemics also sit in this zone because they quantify over semantic objects that are rich enough to include information about the speaker (speaker knowledge and evidence) (see Ritter and Wiltschko 2009, Sigurðsson 2004, Bianchi 2003, Giorgi 2010).

4.6 Spell-out

(67) English main verbs move to Asp*, when not blocked from doing so by another head; -ING forms are in V$_{\text{EVT}}$, and passive participles are in V$_{\text{PASS}}$.

(68) Auxiliaries raise to Fin* when not blocked from doing so by another head

(69) Fin* remains null in the absence of auxiliaries (e.g. simple tense, in the absence of negation or a strong feature in Force)

(70) The ordering of auxiliaries, and the effect of affix hopping is achieved here without morphological lowering or upward probing. The ingredients we needed were:

a. A Cartographic contribution. Ordering of morphemes in the (conceptually grounded) functional sequence

b. A default rule for the spell out of heads in the eventive domain (including the obligatory Asp*) when those heads cannot be filled by raising. This includes the Asp* head in the progressive, and the -ING head when -ING selects passive V$_{\text{EN}}$. This is the only source for auxiliary *be* in the English system.

c. One semantic selectional fact written in to the denotation of T$_{have}$, where T$_{have}$ selects for a particular kind of transitional Asp*P.

d. A featural stipulation on English modals which claims that they exist only in the morphological form that also has a Fin* feature, like the other tensed morphological forms. This needs to be a stipulation because it is an idiosyncratic fact about English (we give this real semantic content via world anchoring.)

5 Adverbs

(71) In languages like English, the ordering of functional elements motivates something on the order of a half-dozen positions in the extended projection of the verb. A few languages have richer morphology and motivate twice or even three times as many positions, but it is rare for a single language to offer evidence for more than ten or twenty morphological slots.

(72) For this reason the adverb evidence presented by Cinque (1999) is vital; he argues that the majority of the functional heads attested in TAM morphology in other languages are corroborated by adverbs in languages like English and Italian, and that furthermore the orderings manifested by those adverbs corroborate the pairwise orderings of the corresponding functional heads

(73) Subsequent work has supported Cinque's findings concerning adverb ordering in other languages (e.g. Nilsen 1997 for Norwegian, Beijer 2005 for Swedish, Alexiadou 1997 for Greek, Rackowski and Travis 2000 for Malagasy, etc.)

(74) Since the adverb facts seem to support a much richer universal hierarchy than we have deduced, we must examine the data carefully. Our account predicts that adverbs will be restricted to domains according to what sorts of elements they modify; an event-modifying adverb should be confined to the e-domain, and if preverbal will therefore follow a situation-modifying adverb, which is confined to the s-domain (cf. also Ernst 2002)

(75) Under close examination of pairs of adverbs, we find several different situations
a. Cases where order is rigidly determined by sortal domains
b. Cases where order is flexible within a sortal domain, as predicted by our account
c. Cases where an adverb can be inserted in either of two sortal

domains, but with the difference in meaning predicted by our account

d.   Cases where an extrinsic factor restricts the ordering

5.1   Order forced by sortal distinctions

(76)   Such cases are fairly straightforward. For example, evidential, epistemic, and speaker-comment adverbials must precede anything that modifies the situation (in the preverbal space), and situation adverbs must precede event-modifying adverbs (cf. Jackendoff 1972, McConnell-Ginet 1982, Ernst 2002)

a.   John fortunately already knows that.
b.   *John already fortunately knows that.
c.   John already quietly declined.
d.   *John quietly already declined.

5.2   Order flexible within a sortal domain

(77)   As an example of (75b), flexible order, consider the facts of *twice*, originally discussed in Andrews (1983)

a.   John intentionally knocked on the door twice
b.   John twice intentionally knocked on the door.
c.   John knocked on the door intentionally twice.
d.   John knocked on the door twice intentionally.
e. ??John intentionally twice knocked on the door.

(78)   Examples (77c) and (77d) on their own might seem to pose a problem for the rigid ordering of a functional sequence that hosts the relevant adverbs. However, Cinque (1999) argues that such a paradox is illusory.

> "The paradox however, is not real, as there is evidence that *twice* belongs to a class of adverbs (*many, few, etc. times, often, rarely, frequently*, etc.) that are systematically ambiguous between two interpretations, each associated with a different position. The higher position quantifies over the entire event (saying how *frequently* it takes place). In [(77c)], for example, it says that there were two events of knocking on the door (intentionally). The lower position, instead, just indicates the *repetition* of the act denoted by

the verb. So [(77d)] says that there was a single event of (intentional) repetition of the act of knocking on the door."
Cinque (1999:26)

(79) As Cinque notes, the right core orders and scopes are derivable from the single underlying structure in (80), with one position for *intentionally* and two positions and interpretations for *twice*.

(80) John (twice$_1$) [$_{XP}$ intentionally [$_{YP}$ knocked (twice$_2$) on the door.]]

(81) Thus far we completely agree with the argumentation. We disagree with the next step which argues that there are therefore two functional heads Asp$_{freq}$ and Asp$_{rep}$ which are ordered on either side of Mod$_{volitional}$ (proposed on Cinque's p. 106).

(82) We agree with the idea that there are (at least) two base positions for *twice*. It also seems to us that the two two relevant positions must be *within* the event sortal domain, below what we have been calling Asp* in the sections above. The reason for this is that both positions and interpretations are possible under a passive auxiliary, as shown here, which has the same pattern of judgements as (77) above.

      a. John was twice intentionally insulted.
      b. John was intentionally insulted twice.
      c. John was insulted twice intentionally.
      d. John was insulted intentionally twice.
      e. ??John was intentionally twice insulted.

(83) We think that one should build semantic representations that 'update' the event variable after functional composition, to reflect the increased complexity of the event description . In this way, can can capture the scopal effects and sensitivity of the adverb to the particular sister it modifies. In (84), we derive the reading for *twice > intentionally*; in (85) we show the derivation for *intentionally > twice*.

(84) *John [$_{VP''}$ twice$_1$ [$_{VP'}$ intentionally [$_{VP}$ knocked on the door]]]*

      a. VP = ⟦knocked on the door⟧
          = λe[knock(e) & on-the-door(e)]
      b. VP′ = ⟦**intentionally** [knocked on the door]⟧
          = $\lambda e'$[intentional(e') & $\exists e$[e ⊂ e' & [$_{VP}$knock(e) & on-the-door(e)]]]
      c. VP″ = ⟦**twice** [**intentionally** [knocked on the door]]⟧
          = $\lambda e''$[twice(e'') & $\exists e'$[e' ⊂ e'' & [$_{VP'}$intentional(e') & $\exists e$[e ⊂ e' & [$_{VP}$knock(e) & on-the-door(e)]]]]]

18

(85) *John [$_{VP'}$intentionally [$_{VP'}$[$_{VP}$knocked] twice$_2$ on the door]].*

    a.   VP = ⟦knocked on the door⟧
          = λe[knock(e) & on-the-door(e)]

    b.   VP′ = ⟦**twice** [knocked on the door]⟧
          = λe′[twice(e′) & ∃e[e ⊂ e′ & [$_{VP}$knock(e) & on-the-door(e)]]]

    c.   ⟦**intentionally** [**twice** [knocked on the door]]⟧
          = λe″[intentional(e″) & ∃e′[e′ ⊂ e″ & [$_{VP'}$twice(e′) & ∃e[e ⊂ e′ & [$_{VP}$knock(e) & on-the-door(e)]]]]]

(86) Crucially, every time a new variable is introduced, the lower one is existentially closed. This gives surface scope without the need to change semantic sorts.

(87) Recall our general principle of semantic compositionality in (17)

    Compositional Coherence: If X embeds YP, then XP is a description of a state of affairs that is a monotonically coherent elaboration of the state of affairs described by YP.

5.3 Adverb ordering flexibility due to sortal underspecification

(88) We also find cases where a single adverb is underspecified, allowing insertion in two different sortal domains. In such cases we predict a difference in readings compatible with the different content of the sortal domains.

(89) The following is a straightforward example.

    a.   John lifted the box easily.
    b.   John is easily the best box lifter in the room.

(90) Such cases are lexically restricted, unlike the situation for *twice*, whose behavior is typical of frequentative adverbs

    a.   John lifted the box laboriously.
    b. *John is laboriously the best box lifter in the room.

(91) In our story this difference in *easily* is a case of sortal ambiguity, and must be distinguished from the *twice* situation, where we deny that any articulation of the functional sequence is required or desirable.

5.4 Other factors

(92) We also find cases where adverb ordering is constrained by other factors, as discussed by Nilsen (2003), Ernst (2007; 2009).

(93) For example, take the order *probably* $\prec$ *once*, noted by Cinque

    a.   John was probably once married.
    b. *John was once probably married.

(94) Since *once* binds t and *probably* quantifies over w, and t and w are parameters of s, these are both located in the same sortal domain. However, worlds are not independent of times. In (94a), the likely worlds each contains a 'once'-time in their past at which John was married; but in (94b), we are looking for a 'once'-time in the past at which John's being married was likely. We suggest that this is formally possible but semantically anomalous.

6 Extroduction

(95) In taking the Minimalist Program seriously, we are forced to reject the rich functional hierarchy as an axiomatic part of UG

(96) In taking the results of the Cartographic enterprise seriously, we are forced to seek a source for the rich functional hierarchy (even C-T-v-V is a functional hierarchy in need of explanation)

(97) We have argued that the rich functional hierarchy has multiples sources, and we suggest that progress will be impeded if the functional hierarchy is ignored (as in some Minimalist work) or taken for granted (as in some Cartographic work).

(98) The most important source that we identify is grounded, we argue, in extralinguistic cognition: A cognitive proclivity to see the world in terms of events, situations, and propositions (with analogous ontologies for other extended projections).

(99) Additional sources of ordering, we suggest, must be distinguished from the ordering of the sortal domains.

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