Root Transformations & Quantificational Structure

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Hooper and Thompson (1973) suggest that availability of "Root Transformations" (RTs) correlates with semantic assertion: RTs may occur in clauses expressing asserted, but not presupposed, content (cf. (1)-(3)):

(1) a. *Mildred bought a Mercedes
[**when**/**before**/**after** her son, he purchased stock in Xerox].
b. Mildred bought a Mercedes
[**when**/**before**/**after** her son purchased stock in Xerox].
Presupposes: Mildred's son purchased stock in Xerox.

(2) a. Mildred drives a Mercedes [**because** her son, he owns stock in Xerox].
b. Mildred drives a Mercedes [**because** her son owns stock in Xerox].
Asserts: Mildred's son purchased stock in Xerox.

(3) a. *[**Because** her son, he owns stock in Xerox], Mildred drives a Mercedes.
b. [**Because** her son owns stock in Xerox], Mildred drives a Mercedes.
Asserts: Mildred drives a Mercedes.

Semantic quantification theory also invokes presupposition and assertion (Partee 1991). In typical tripartite structures, including adverbial quantifications, restrictions correspond to presupposed material, scopes correspond to asserted material (4):

(4) a. Always when I eat spicy food I regret it afterwards .
b. **Quant.** **Restriction** (Presupposed) **Scope** (Asserted)

This suggests a potential explanatory connection between semantic function & RT availability:

- Adverbial clauses forbidding RTs are in quantificational restrictions.
- Adverbial clauses allowing RTs are in quantificational scopes.
- Some property of RTs blocks them from quantificational restrictions, but permits them in scopes

Here:

- We investigate whether the quantificational picture can be sustained for temporal and causal clauses.
- We (very tentatively) suggest "semantic intervention" as excluding RTs from quantificational restrictions

1.0 Adverbial Quantification

(5) **Relational View of (Monadic) Quantifiers**
Q ({x: A(x)} , {y: B(y)})
{x: A(x)} – Restriction argument
{x: B(x)} – Scope argument

(6) a.i. All fish swim.
ii. ALL({x: fish(x)}, {y: swim(y)})
iii. {x: fish(x)} ⊆ {y: swim(y)}
b.i. No pigs fly.
ii. NO({x: pigs(x)}, {y: fly(y)})
iii. {x: pigs(x)} ∩ {y: fly(y)} = ⌀
c.i. Most birds fly.
ii. MOST({x: pigs(x)}, {y: fly(y)})
iii. |{x: pigs(x)} ∩ {y: fly(y)}| > |{x: pigs(x)} - {y: fly(y)}|

Nominal & adverbial quantification differ: the former can range over all entities in the universe of discourse; the latter is more restricted, ranging over sets of times (7a) or eventualities (7b):

(7) a. Q (λt[A(t)] , λt[B(t)]) (Stump 1981, 1985)
b. Q (λe[A(e)] , λe[B(e)]) (Chierchia, 1990, de Swart 1993) ✓

Adverbial quantifications also commonly have unexpressed restrictions, with content drawn from context (8a)/(8b.i), or derived from the sentence itself (8b.ii-iv):

(8) a. John usually talks too much.
"In most **contextually relevant situations**, John talks too much."
b. John usually steams Chinese dumplings.
i. "In most **contextually relevant situations**, John steams Chinese dumplings."
ii. "In most **contextually relevant situations where John steams something**, John steams Chinese dumplings"
iii. "In most **contextually relevant situations where John steams dumplings**, John steams Chinese dumplings"
iv. "In most **contextually relevant situations where John deals with Chinese dumplings**, John steams Chinese dumplings"

Following Rooth (1985), sentence-internal restrictions like (8b.ii-iv) have been widely taken to arise by **focus** – i.e., adverbial Qs are focus-sensitive elements that associate with material in their scope. The restrictions in (8b.ii-iv) correspond with focal assignments (9a-c) (resp.), where the boldfaced materials match-up:

(9) a. Usually **John steams** [$_{\textbf{FOCUS}}$ Chinese dumplings].
b. Usually **John steams** [$_{\textbf{FOCUS}}$ Chinese] **dumplings**.
c. Usually **John** [$_{\textbf{FOCUS}}$ steams] **Chinese dumplings**.

Adverbial Qs are widely assumed to exhibit their full argument structure in conjunction with adverbial *if*/*when*/*before*/*after*-clauses (10a-d). The latter supply the restriction arg; the main clause supplies the scope (11a-c):

(10) a. Sometimes [$_{CP}$ **if John is sleepy**] he drinks green tea.
b. Usually [$_{CP}$ **when John cooked**] he steamed Chinese dumplings
c. John always shaves [$_{CP}$ **when he is in the shower**].
d. John never washed vegetables [$_{CP}$ **before eating them**].

(11) a. SOMETIMES (**λe[John is sleepy(e)]**) (λe[John drink green tea(e)])
b. USUALLY (**λe[John cooked(e)]**) (λe[John steamed C. dumplings(e)])
c. ALWAYS (**λe[John in the shower**]) (λe[John shaves(e)])

When *if*/*when*/*before*/*after*-clauses occur without an overt adverbial quantifier (12a), a covert one may be assumed (Heim 1982) (12b):

(12) a. When John visited Paris, he ate in a café.
b. SOMETIME (λe[John visited Paris(e)]) (λe[John ate in a café(e)])

This permits ambiguity in (13). On reading (13a), the *when*-clause restricts *always* (14a); on reading (13b), the *when*-clause restricts a covert adverb; *always* quantifies over contextuallly relevant parts of the larger visitation-event (14b)

(13) When John visited Paris, he always ate in a café.
a. "In all situations in which John visited Paris, he ate in a café."
b. "At the time John visited Paris, in all relevant situations, John ate in a café."

(14) a. ALWAYS (λe[John visited Paris(e)]) (λe[John ate in a café(e)])
b. SOMETIME (λe[John visited Paris(e)])
(λe[ALWAYS (λe'[C(e) & Π(e',e)]) (λe'[John ate in a café(e')])

In all these cases, the *if*/*when*/*before*/*after*-clause restricts an adverb of quantification.

2.0 *When/Before/After*-Clauses, Presupposition & RTs

Hooper and Thompson (1973) state: "Some adverbial subordinate clauses, such as those beginning with *when*, *before* and *after*, are … always presupposed, and RTs do not apply within them" (pp.494-495):

(15) a. *Helen and Jack had dinner [**before into the kitchen trooped the children**].
b. *The villagers all burst into song [**when in came the bride and groom**].
c. *We were all much happier [**when upstairs lived the Browns**].
d. *The guests laughed out loud [**after Mary stopped singing, strangely**].
e. *The customer stomped out [**after the clerk, I guess, insulted her**].
(= (251-255) in H&T 1973))

H&T's correlation appears to fit smoothly with the semantics sketched above:

- *When*/*before*/*after*-clauses uniformly restrict (overt/covert) Q adverbs
- In a tripartite quantificational structures, restrictions represent presupposed information. There is **presupposed** to be a domain of individuals satisfying the restriction of which the scope is asserted to hold:

(16) a. Always when I eat spicy food I regret it afterwards .

b. **Quant.** **Restriction** (Presupposed) **Scope** (Asserted)

- RTs are blocked in presupposed environments.
- RTs are blocked in *when*/*before*/*after* clauses.

2.1 Asserted *When/Before/After*-Clauses?

With normal intonation, (17a) (based on de Swart 1993) naturally answers (18a), but not (18b). Conversely, (17b) naturally answers (18b), but not (18a):

(17) a. [**After the war ended**] John lived in London.
b. John lived in London [**after the war ended**].

(18) a. **Where** did John live after the war ended?
b. **When** did John live in London?

Answers typically constitute focused/asserted material. As an answer to (18b), the *after*-clause in (17b) thus seems to be asserted. Despite this, RTs are blocked (19):

(19) Q: When did John live in London?
A: *John lived in London [**after the war, it had ended**].

Similarly, (20a) has reading (20b), where *after*-CP restricts Q adverb and is presupposed. But (20a) also has reading (20c) where the args seem reversed. The two readings are brought out by different emphasis (Rooth 1985).

(20) a. Marty always shaves when he is in the shower.
b. Always (λe[Marty is in the shower(e)]) (λe[Marty shaves(e)])
(cf. *Marty always SHAVES when he is in the shower*.)
c. Always (λe[Marty shaves(e)]) (λe[Marty is in the shower(e)])
(cf. *Marty always shaves when he is in the SHOWer*.)

Readings where the main clause gives the restriction and the adverbial clause the apparent scope are natural for (21a-d) (from Johnston 1994):

(21) a. Frances always breaks up with lovers when it is raining.
b. Sharks usually attack people when they are hungry.
c. Edward always submits an abstract when the deadline is very near.
d. Marcia always goes to the store before it gets dark.

Scopal material is asserted. The *when*-clauses in (20a) and (21a-d) thus seem to be asserted on the relevant readings Nonetheless, RTs are uniformly blocked:

(22) a. Q: When does Marty always shave?
A: *Marty always shaves [**when in the shower, he is**].
b. *Edward always submits an abstract [**when the deadline, it is very near**].

These results seem to undermine the correlation between *when*/*before*/*after*-clauses, presupposition and RT absence.

2.2 A More Refined Semantics (Johnston 1994)

We believe the problem raised by "asserted *when*/*before*/*after*-clauses" arises from an inadequate semantics. The account of adverbial quantification in Johnston (1994) appears to resolve the puzzle.

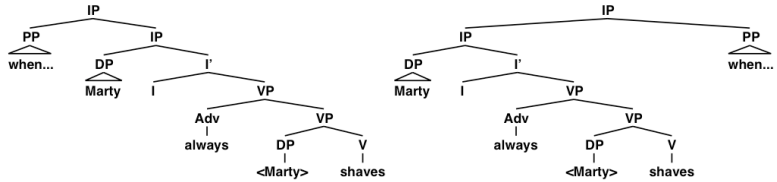
Adjunct restriction reading (ARR): *when*/*before*/*after*-clause gives Q-restriction.
Head restriction reading (HRR): main clause gives Q-restriction.

2.2.1 The Adjunct Restriction Reading

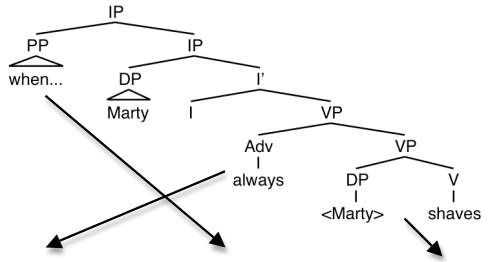
Johnston derives the ARR of (23a) from the IP adjunction structures in (23c) via (24):

(23) a. Marty always shaves when he is in the shower.
b. Always (λe[Marty is in the shower(e)]) (λe[Marty shaves(e)])
(cf. *Marty always SHAVES when he is in the shower*.)

c.



(24) **Determining the Restriction & Nuclear Scope of an Adverb of Quantification**:
(i) Make the Q adverb the first element in the tripartite structure.
(ii) Factor VP material c-commanded by the Q adverb into the nuclear scope.
(iii) Factor material adjoined to IP or in Spec of IP into the restriction.



(25) **always′** {**when′$_{e_2}$**(**in′**(*Marty*, *the shower*, e_2))} [**shaves′**(*Marty*, e_1)]
Q **Restriction** **Scope**

Here **when′$_{e_2}$**(**in′**(*Marty*, *the shower*, e_2)) denotes a set of time intervals.

(26) a. *Marty is in the shower* ⇒ **in'**(Marty, the shower, e)
b. *when* ⇒ λφλi[∃e[MAX(φ)(e) & i = **RT**(e)]
c. *when Marty is in the shower* ⇒ λi [∃e[MAX(**at'**(Marty, the shower, e)) & i = **RT**(e)]

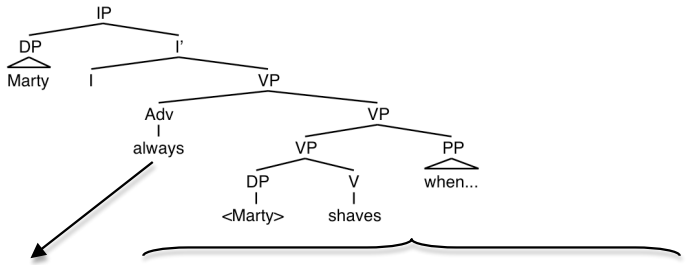
(25) translates: **"**For each time interval that is the run-time of a maximal event of Marty being in the shower there is an interval contained in it corresponding to the run-time of an event of Marty shaving."

For Johnston, ARRs constitute quantifications over time intervals.

2.2.2 The Head Restriction Reading

Johnston derives the HRR of (27a) from the VP adjunction structure in (27c), again via (24):

(27) a. Marty always shaves when he is in the shower.
b. Always (λe[Marty shaves(e)]) (λe[Marty is in the shower(e)])
(cf. *Marty always shaves when he is in the SHOWer*.)
c.



(28) **always′** { } (**∃** {**when′$_{e_2}$**(**in′**(*Marty*, *the shower*, e_2))} ([**shaves′**(*Marty*, e_1)])
Q **Restr** **Scope**

This yields no restriction for **always'**, violating (29) (Kratzer 1995). Johnston assumes a process of **eventuality variable binding** that yields (30):

(29) **Prohibition against Vacuous Quantification**: For every quantifier Q, there must be a variable x such that Q binds an occurrence of x in both its restrictive clause and its nuclear scope.

(30) **always′** {**shaves′**(*Marty*, e_1)}
(∃ {**when′$_{e_2}$**(**in′**(*Marty*, *the shower*, e_2))} ([**shaves′**(*Marty*, e_1)])

"For each eventuality of Marty shaving there is an eventuality of Marty being in the shower whose run-time contains the interval of the shaving."

Thus, for Johnston, HRRs constitute quantifications over time intervals.

2.2.3 Implications

Johnston's (25)/(30) differ sharply our earlier (20b,c):

- *When* is semantically contentful, not a simple "restriction marker" (contra Lewis 1975, Heim 1982, Kratzer 1986)

- J's adjunct and head restriction readings are not simple inverses.
- ARRs quantify over time intervals.
- HRRs quantify over event(ualitie)s.

(31) a. Marty always shaves when he is in the shower. Ambiguous
b. Marty always SHAVES when he is in the shower. (ARR)
c. Marty always shaves when he is in the SHOWer. (HRR)

(32) a. Marty is always in the shower when he shaves. Unambiguous !
b. Marty is always in the SHOWer when he shaves. (ARR)
c. Marty is always in the shower when he SHAVES. (**ARR**!)

Most importantly for us:

- In J's HRR, the *when*-clause does not become the whole scope, but only part of it. Within the scope it functions as a Q-restriction on an inner ∃.

Thus under Johnston (1994), we can preserve H&T's core contention: "adverbial subordinate clauses, such as those beginning with *when*, *before* and *after*, are … always presupposed, and RTs do not apply within them."

2.3 The Syntax-Semantics Mapping Revisited

Johnston (1994) doesn't derive head restriction readings via focus (contra Rooth 1985); rather he calculates them directly from his structures via (24). J claims the fact (21a-d) get natural HRRs without special focal emphasis supports this view:

(21) a. Frances always breaks up with lovers when it is raining.
b. Sharks usually attack people when they are hungry.
c. Edward always submits an abstract when the deadline is very near.
d. Marcia always goes to the store before it gets dark.

Nonetheless, J's structures and mapping principle (24) seem dubious to us.

Johnston associates ARRs with symmetric IP adjunction of the *when*/*before*/*after*-clause. This can't be right. Reinhart (1983) notes preposed adverbial clauses don't trigger Principle C violations, but postposed ones do:

(33) a. When sharks are hungry they usually attack people.
b. *They usually attack people when sharks are hungry.

Also, examples with only ARRs allow *when*/*before*/*after*-clauses to be captured by VP ellipsis (34); so PP must be able to attach within VP:

(34) Marty always is in the shower when he shaves, and Peter always is ⌀ too.

We won't attempt to revise J's syntax for *when*/*before*/*after*-clauses, but will make a general point about the syntax - semantics mapping in adverbial quantification.

2.3.1 Adverbial Qs as Indefinite Pronouns/Pronominals Qs

Adverbial Qs are often compared directly to Ds as in (35)/(36); the adverbial clause is seen as congruent to the NP complement of D:

(35) a. All travelers enjoy a change of scenery.
a. Always, when one travels, one enjoys the change of scenery.

(36) a. All (λx[traveler(x)]) (λx[enjoy-change-of-scenery(x)])
b. Always (λe[someone-travels(e)]) (λe[he/she-enjoys-change-of-scenery(e)])
Quantifier **Restriction** **Scope**

But then why do adverbial Qs so often omit their restriction arg, and why do *when*/*before*/*after*-clauses occur distantly from them when they do occur??

Better analogies: (37) and (39), with mappings (38) and (40) (resp.):

(37) a. Anyone who travels enjoys a change of scenery.
b. Always, when one travels, one enjoys the change of scenery.

(38) a. Any (λx[**one**(x)]) (λx[travels(x)]) (λx[…-change-of-scenery(x)])
b. Al (λe[**way**(e)]) (λe[someone-travels(e)]) (λe[…-change-of-scenery(e)])
Quant **Restr** **Modifier** **Scope**

(39) a. Most who travel enjoy a change of scenery.
b. Mostly, when one travels, one enjoys the change of scenery.

(40) a. Most (λx[C(x)]) (λx[travels(x)]) (λx[…-change-of-scenery(x)])
b. Mostly (λe[C(e)]) (λe[someone-travels(e)]) (λe[…-change-of-scenery(e)])
Quant **Restr** **Modifier** **Scope**

Indefinite pronouns (*anyone*, *everywhere*, *everything*, etc.) seem to <u>incorporate</u> their nominal restriction argument (*-way*, *-where*). Similar incorporated nominal morphology occurs with adverbs like *al-ways* and *some-times*.

Pronominal quantifiers (*many, few, most*, etc.) can take an <u>unexpressed pro-nominal restriction</u>. The same seems true of counterpart adverbs (*mostly, often, rarely*).

On this view, *when*/*before*/*after*-CP/PPs in adverbial quantification would <u>not</u> correspond to NPs in nominal quantification, but rather to <u>extraposed RCs</u>.

(41) a. As for jobs,
Many that involve computers pay well [$_{RC}$ that involve computers].
b. Often when it involves computers a job pays well [$_{AC}$ when it involves computers]

This may also illuminate an important implicit assumption in Johnston (1994): that adverbial Qs are uniformly <u>count</u> quantifiers; this is crucial to explaining the asymmetry in (31)/(32). If Q could be a mass Q, then HRRs would be possible with atelic e's in the main clause; indefinite pronouns are <u>count quantifiers</u>.

3.0 *Because*-Clauses, Presupposition & RTs

H&T (1973) note a complex RT distribution in sentences with *because*-clauses. They distinguish **non-restrictive *because*-clauses**, which supply the reason for the speaker's assertion or question (42a), from **restrictive *because*-clauses**, which supply the reason for the main clauses events (42b):

(42) a. Sam is going out for dinner, because I just talked to his wife. **NRes**
b. Sam is going out for dinner because his wife is cooking Japanese food. **Res**
(= (224-225) in H&T 1973))

In sentences with a final restrictive *because*-clause, the latter permits RTs (43a-g) whereas the main clause resists them (44a-c):

(43) a. Helen and Jack stopped eating
[**because into the kitchen trooped the children**].
b. The villagers burst into song [**because in came the bride and groom**].
c. We were all much happier [**because upstairs lived the Browns**].
d. The guests laughed out loud [**because Mary stopped singing, strangely**]
e. The customer stomped out [**because the clerk, I guess, insulted her**]
f. ?Max left the room [**because "I won," Alice exclaimed**]
g. Max was quiet [**because Alice was sleeping, wasn't she?**]

(44) a. ***In came Jerry** because it was raining.
b. ***That house there are ghosts in it** because they like it there.
c. ***Sitting in the corner was Tom** because he'd hidden grandma's teeth.
(= (234-236) in H&T (1973))

With initial restrictive *because*-clauses, the picture seems to us to reverse. RTs are possible in the main clause (45), but largely unavailable in the adverbial clause (46):

(45) a. Because Helen and Jack had stopped eating
[**into the kitchen trooped the children**].
b. Because the villagers had burst into song [**in came the bride and groom**].
c. Because we had invited them warmly [**upstairs lived the Browns**].

d. Because the guests laughed out loud [**Mary stopped singing, predictably**].
e. Because the customer stomped out [**the clerk, I guess, blushed**].
f. ?Because Max left the room [**"I won," Alice exclaimed**]
g. Because Max was quiet [**Alice fell asleep, didn't she?**]

(46) a. *?[**Because into the kitchen trooped the children**]
Helen and Jack stopped eating.
b. *?[**Because in came the bride and groom**] the villagers burst into song.
c. *?[**Because upstairs lived the Browns**] we were all much happier.
d. ?[**Because Mary stopped singing, strangely**] the guests laughed out loud.
f. *?[**Because "I won," Alice exclaimed**] Max left the room.
g. *?[**Because Alice was sleeping, wasn't she?**] Max was quiet.

H&T analyze the situation in (43) and (44) as follows:

- In a sentence with a (final) restrictive *because*-clause, the main clause represents presupposed info and the adverbial represents asserted info.
- RTs are permitted in asserted, but not presupposed, environments.
- Hence: RTs are permitted in a (final) restrictive *because*-clause, but not in the main clause:

(47) [Sam went out for dinner] [because his wife cooked Japanese food].

Main Clause	***Because*-clause**
Presupposed	**Asserted**
***RTs**	**RTs** ✓

On this view, initial restrictive *because*-clauses should have the associations in (48):

(48) [Because his wife cooked Japanese food] [Sam went out for dinner]

***Because*-clause**	**Main Clause**
Presupposed	**Asserted**
***RTs**	**RTs** ✓

This seems correct. (49a) is naturally answered by (49b), but not by (49c). Similarly, "Right?" in (50a) seeks confirmation of Sam's reason for going out to dinner; "Right?" in (50b) seeks confirmation only of Sam's going out to dinner:

(49) a. Why did Sam go out to dinner?
b. Sam went out for dinner [because his wife cooked Japanese food].
c. ??[Because his wife cooked Japanese food] Sam went out for dinner.

(50) a. Sam went out for dinner because his wife cooked Japanese food. Right?
b. Because his wife cooked Japanese food, Sam went out for dinner. Right?

3.1 The Semantics of *Because*-Clauses

We linked the presuppositional status to semantic function with *when*/*before*/*after*-clauses. The latter interpret uniformly as restrictions on Q-adverbs, and restrictions are presupposed. This opened the possibility of linking the availability of RTs to the Q-restriction function. Can such a connection be made with *because*?

3.1.1 Bi-sentential/Propositional Connective

Causation is often analyzed via a bisentential connective; Dowty (1972, 1979) offers the analysis in (51), based on Lewis' (1973) account of counterfactuals. A natural correlate is that *because* also expresses a propositional connective **BECAUSE**; specifically, φ BECAUSE ψ iff ψ CAUSE φ.

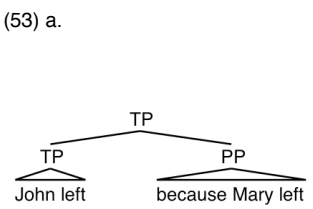
(51) a. **[φ CAUSE ψ]** is true iff (i) φ is a causal factor for ψ, and (ii) for all other φ' such that φ' is a causal factor for ψ, some ¬φ world is more similar to the actual world than any ¬φ' world is.
b. **φ is a causal factor for ψ** iff there is a series of sentences φ, φ_1,…, φ_n, ψ (for n ≥ 0) such that each member of the series depends causally on the previous member.
c. **φ depends causally on ψ** iff φ, ψ and ¬φ □→ ¬ψ are all true.

Similary, Johnston (1994) offers the propositional analysis in (52):

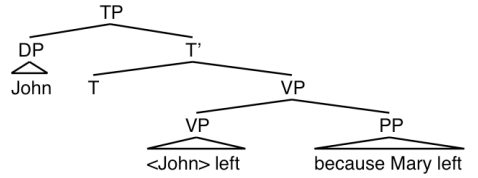
(52) **because'(X,Y)** is true iff X and Y are propositions and X, the result, is true as a result of Y.

These semantic analyses fit a traditional syntax involving high attachment of *because*-clauses to a proposition-denoting phrase (TP, VP) (53):

(53) a.



b.



But they don't support our leading idea; main & adverbial clause are not related as parts of a quantificational structure. Furthermore, there's no clear way of deducing the informational structure of *because*-constructions from the propositional semantics.

3.1.2 Event Relation (Larson 2004)

Davidson (1967): CAUSE is a binary relation between event(ualitie)s: one eventuality causes another (54). If sentences quite generally express quantifications over events (55a,b), then CAUSE will connect event quantifications by (55c):

(54) CAUSE(e, e')

(55) a. *John sneezed* ⇒ ∃e[sneezing(e) & Agent(e,j) & Past(e)]
b. *Mary ran* ⇒ ∃e'[running(e') & Agent(e',m) & Past(e')]
b. *John's sneezing made Mary run* ⇒
∃e∃e'[sneezing(e) & Agent(e,j) & Past(e) & **CAUSE**(e,e') &
running(e') & Agent(e',m) & Past(e')]

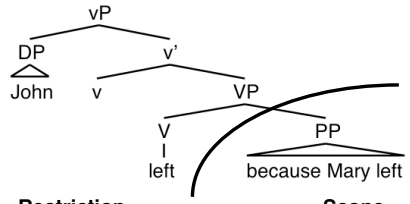
Larson (2004) proposes that final *because*-clauses involve structured event quantification (56).

(56) a. John left [**because** Mary left]
b. ∃e [leaving(j, e)] [∃e'[leaving(m, e') & **CAUSE(e', e)**]]

Q **Restr** **Scope**
"For some leaving by John, it was because Mary left"

Structured event-quantification fits a right-descending syntax under a Mapping Hypothesis in which the lowest event predicate maps to the scope:

(57)



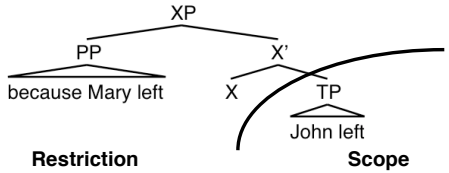
Q	**Restriction**	**Scope**
∃	λe[leaving(j, e)]	λe[∃e'[leaving(m, e') & **CAUSE(e', e)**]]

- In right-ascending theory, *because*-clauses are outermost adjuncts (53a,b). This tracks their semantic analysis as propositional operators.
- In right-descending theory, they must be innermost complements. How might this follow?

Davidson (1967): causal relations individuate events: events with same causes & effects are the same event. Suppose ϴ-hierarchy reflects individuation. Innermost status for *because*-clauses makes sense: in determining event identity, causal relations outrank space-time location, manner, participants, etc. and hence comes closest.

This picture can be extended to initial *because*-clauses under the view of Reinhart (1983) that they occupy a higher projection (XP):

(58)



Q	**Restriction**	**Scope**
∃	λe[∃e'[**CAUSE(e',e)** & leaving(m, e')]]	λe[leaving(j, e)]

Again the lowest event predicate maps to the scope; the residue yields the restriction.

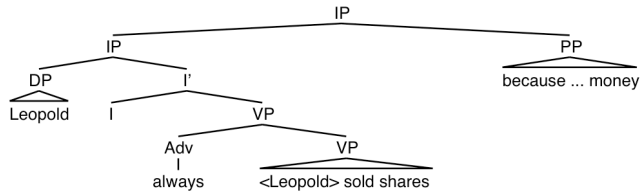
3.2 *Because*-Clauses and Q Adverbs

This analysis can capture core data of the propositional account. E.g., Johnston (1994) notes the ambiguity of (59):

(59) Leopold always sold shares because he needed money.
a. **Quantifer head reading** (QHR): "On all relevant occasions, Leopold sold shares, and the reason for this pattern was that he needed money"
b. **Quantifer adjunct reading** (QHR): "On all occasions that Leopold sold shares, he reason for doing so was that he needed money"

(60) a. Frankie always misses the bus because he is a slow runner. (QHR)
b. Leopold always robs a bank because he needs to make money fast. (QAR)

(61) **Quantifer Head Reading**
a.

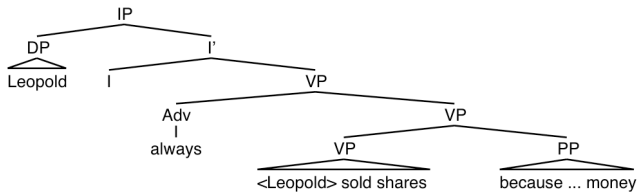


b. **because'**(**always { C }** [**sell'**(*Leo*, *shares*, $\mathbf{e_1}$)], **need'**(*Leo*, *money*, $\mathbf{e_2}$))

Q Restr Scope

(62) **Quantifer Adjunct Reading**

a.



b. **always'** **{ }** [**because'**(**sell'**(*Leo*, *shares*, $\mathbf{e_1}$)) **need'**(*Leo*, *money*, $\mathbf{e_2}$)]

Q Restr Scope

c. **always'** **{ sell'**(*Leo*, *shares*, $\mathbf{e_1}$**}**
[**because**(**sell'**(*Leo*, *shares*, $\mathbf{e_1}$)) **need'**(*Leo*, *money*, $\mathbf{e_2}$)]

3.3 Quantifications as States

The QHR/QAR ambiguity can be captured by taking quantifications as states that can themselves enter causal relations:

(63) a. Q **(** {x: A(x)} , {y: B(y)} **)** **Old View**
{x: A(x)} – Restriction argument
{x: B(x)} – Scope argument
b. Q **(** {x: A(x)} , {y: B(y)} , **e*)** **New View**
{x: A(x)} – Restriction argument
{x: B(x)} – Scope argument
e* – State argument

(64) **Quantifer Head Reading**
∃e*[**Always(**C, λe'[Leo sell shares(e')], e*) & ∃e[Leo need money(e) & **CAUSE**(e,e*)]]

(65) **Quantifer Adjunct Reading**
Always(C , λe[Leo sell shares(e) & ∃e'[Leo need money(e) & **CAUSE**(e',e)]], e*)
Always(λe[Leo sell shares(e),
λe[Leo sell shares(e) & ∃e'[Leo need money(e) & **CAUSE**(e',e)]], e*)

(65) is similar to HRR of temporal adverbial clauses: main clause supplies restriction on **always'**; but (59) has no reading equivalent to ARR, where the *because*-clause supplies the restriction:

(66) **Adjunct Restriction Reading**
Always(λe[∃e'[Leo need money(e) & **CAUSE**(e',e)]], λe[Leo sell shares(e)], e*)
"Every eventuality caused by the state of Leopold needing money is an eventuality of Leopold selling shares."

Our conjecture: this reading is out for the same reason HRRs are unavailable with non-telic main clauses; **CAUSE** obtains between eventualities of all types, hence λe[∃e'[Leo need money(e) & **CAUSE**(e',e)]] is simply indeterminate wrt telicity, and countability. It's not sortal.

4.0 RT Distribution

Under a quantificational analysis, informational properties of *when*/*before*/*after*-clauses and *because*-clauses track their semantic function; these properties also track RT availability:

- When adverbial clauses denote presupposed material, they are in quantificational restrictions; in these circumstances they also disallow RTs.
- When adverbial clauses denote asserted material, they are in quantificational scopes; in these circumstances they also allow RTs..

This suggests RT availability might follow from semantic function (restriction/scope) and not directly from pragmatics or info structure (presupposed/asserted), contra H&T.

4.1 Syntactic Accounts

Current analyses typically try to derive RT distribution syntactically.

4.1.1 Clause "Size"

Haegeman (2003): RTs are available only in constructions with fully expanded left peripheries (Rizzi 1997):

(67) a. (Sub) Top* Focus Force Fin IP (Full Left Periphery Allows RTs)
b. Sub Fin IP (Truncated Left Periphery Forbids RTs)

Adverbial clauses allowing RTs have fully projected left peripheries. Adverbial clauses blocking RTs have truncated left peripheries.

Sawada and Larson (2004): an additional existential quantifier in the semantics of *because* vs. *when*/*before*/*after* corresponds to a head whose spec hosts RTs:

(68) a. *when/before/after* **[**$_{YP}$ ... **]**
b. *because* [$_{XP}$ [$_{X'}$ ∃e **[**$_{YP}$ ... **]**]]
c. *because* [$_{XP}$ her son [$_{X'}$ ∃e [$_{YP}$ he owns stock in Xerox]]]

Problem: *Because*-clauses don't behave uniformly. In final position, they host RTs (43); preposed they don't. This would seem to require *because* to project its complement differently (full/truncated) according to its position.

4.1.2 Syntactic Intervention?

Haegeman (2009): Temporal & conditional clauses involve fronted operators bearing a Q feature. Preposed RT items like topics also bear Q (in the complex δ+Q) and block the relation between OP and trace (69):

(69) *when this problem you are able to solve t
Q δ+Q (topic) Q

This view is based on Geis (1970a,b), who observes that *when*/*before*/*after*-clauses show long distance readings indicative of movement:

(70) I saw Mary in NYC **when**/**before**/**after** she said [she was there]

Problem: Not all temporal clauses show long distance readings; e.g., *while*-clauses don't (Larson 1990).

(71) I saw Mary at the mall **while** she said [she was at home sleeping]

(cf. *I saw Mary at the mall* ***during the time*** *she said she was at home sleeping*.)

This fact is unsurprising; *when*-clauses derive transparently from interrogative forms. *Before*/*after*-clauses descend from IE comparatives (*earlier than/later than*), which also involve operator movement. *While* has no such operator-linked history.

Nonetheless, *while* clauses block RTs in English just like *when*/*before*/*after*.

(72) a. *Helen and Jack had dinner [**while into the kitchen trooped the children**].
(cf. *Helen and Jack had dinner [before into the kitchen trooped the children])

b. *The villagers all burst into song [**while in came the bride and groom**].
(cf. *The villagers all burst into song [when in came the bride and groom].)
c. *We were all much happier [**while upstairs lived the Browns**].
(cf. We were all much happier [when upstairs lived the Browns].)
d. *The guests laughed out loud [**while Mary was singing, strangely**].
(cf. *The guests laughed out loud [after Mary stopped, strangely].)
e. *The customer stomped out [**while the clerk, I guess, insulted her**].
(cf. *The customer stomped out [after the clerk, I guess, insulted her].)

Problem: *Because*-clauses don't behave uniformly. An intervention account would seem to require operator structure in initial *because*-clauses (blocking RTs), but not in final ones (allowing RTs).

4.2 Semantic Intervention?

Analyses of quantification within DRT-style theories assume an asymmetry in the restriction & scope: both contain a variable bound by the quantifier, but the scope in addition undergoes **existential closure**, which captures all remaining variables in it (73):

(73) a. Every man owns a donkey
Q **Rest** **Scope**
b. ∀x [man(x)] [donkey(y) & own(x,y)]
c. ∀x [man(x)] ∃**y**[donkey(**y**) & own(x,**y**)] "Existential closure"

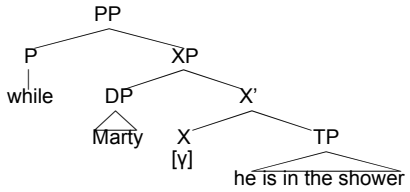
This is faithful to our basic picture of quantification in which Q-many elements of a domain satisfying the restriction are asserted of a scope.

- Assertions must be truth-evaluable, hence all variables must be bound; asserted formulae must be closed (cf. Krifka 1992)
- Restrictions, on the other hand must be open sentences.

Given these points we might reason as follows

- H&T observation: RTs track asserted environments.
- The key feature of assertions is that they closed.
- The presence of "high, left elements," whether by dislocation (Topicalization) or base generation (Left Dislocation), is interpreted as assertion, i.e., RTs trigger closure.
- **Hence**: RTs are possible only where closure is possible.

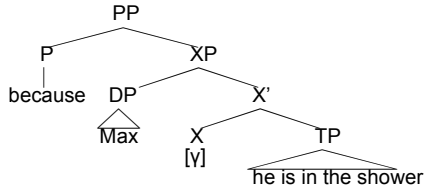
(74) ***While*-Clause (in Restriction)**



[γ] = "close my projection"

(75) a. *Marty is in the shower* ⇒ **in'**(Marty, the shower, e)
b. *while* ⇒ λφλi[∃e[MAX(φ)(e) & i = f(e)]
c. *while Marty is in the shower* ⇒ λi [∃e[MAX(**at'**(Marty, shower, e)) & i = f(e)]
d. *Marty, he is in the shower* ⇒ ∃e[**in'**(Marty, the shower, e)]

(76) ***Because*-Clause (in Restriction)**



(77) a. *because* ⇒ λφλe[∃e'[**CAUSE**(e',e) & (φ)(e)]
b. *because Marty is in the shower* ⇒ λe[∃e'[**CAUSE**(e',e) & (**at'**(Marty, shower, e'))]
c. *Marty, he is in the shower* ⇒ ∃e[**in'**(Marty, the shower, e)]

In both restriction cases, closure captures the event variable, making it unavailable for binding by *while* and *because*.

(78) ***Because*-Clause (in Scope)**

Marty, he is in the shower ⇒ ∃[**in'**(Marty, the shower, e)]] !!

If closure does not capture the main variable (e) in the scope, as in (73c), then the latter will remain open for binding by *because*. RTs will be "semantically harmless".

Unresolved question: How is e identified as the main variable in (78)? We leave this for further investigation. ☺

SUMMARY

- RTs appear to occur in asserted but not presupposed environments.
- *When*/*before*/*after*-clauses and *because*-clauses can be analyzed as parts of quantificational structures, where RT availability tracks occurrence in scope.
- This suggests the possibility of a semantic account of RT availability.
- We briefly reviewed syntactic approaches, noting some difficulties.
- We tentatively suggested a "semantic intervention" account in which RTs trigger existential closure, binding all available variables in a restriction, and all but the main variable in the scope.

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