Adverbs of Quantification and Genericity[1]

Carmen Dobrovie-Sorin

CNRS-UMR 7110, Université Paris 7

Theorists agree that generic sentences of the type illustrated in (1) rely on a default GEN operator, which is assumed to be a silent adverb of quantification (Q-adverb henceforth) roughly corresponding to *usually* or *generally*:

(1) a. A bird flies.
 b. A dog barks.

There is, however, no general agreement regarding the domain over which GEN quantifies. The two main available analyses are shown in (1^1) and (1^2):

(1^1) a. GENe,x,t (bird (x) ∧ C(e,x,t)) [fly (e,x,t)]
(1^2) a. GENx (x is a bird) [x flies]

According to the representation in (1^1), GEN quantifies over tuples of events, individuals and times (see Chierchia (1995a,b), Schubert & Pelletier (1988), Krifka & alii (1995), among many others). The alternative option shown in (1^2) is based on the idea that GEN quantifies over the individual-variable supplied by the indefinite (Heim (1982), Diesing (1992)).

I will argue that both of these analyses are faced with empirical problems that can be solved if we assume that habitual sentences of the type in (1) involve two, rather than just one, default operators:

(1^3) a. **GEN**x (x is a bird) [**HAB**t [x flies at t]]

These two operators carry distinct labels (GEN and HAB, respectively) because they are distinct: HAB is a unary operator that binds the time-variable and functions as a frequency adverb, whereas GEN is a relational operator.

Some authors argued that Q-adverbs can directly quantify *only* over events (or over tuples of events and individuals (and times)), in which case quantification over individuals is to be treated as being either derived from quantification over events (Rooth (1985, 1995)), or as "pseudo-binding" (de Swart (1991, 1996)) or as being due to multiple binding (Chierchia (1995a,b)) I will show that Q-adverbs must be allowed to

[1] A hard copy of this paper will appear in C. Beyssade, O. Bonami, P. Cabredo-Hofherr and F. Corblin (eds.) *Empirical Issues in Formal Syntax and Semantics 4*, Selected Papers from the Colloque de syntaxe et sémantique à Paris (CSSP 2001), Presses Universitaires de la Sorbonne.

directly quantify over individuals not only in those generic sentences that express generalizations over individuals (see (1) or the even clearer examples built with i-level predicates, e.g., *A cat is intelligent*), but even in *when/if* clauses, which constitute the paradigmatic example of quantification over events.

1 Habitual characterizing sentences: quantification over events or over individuals?

1.1 Event-based accounts

According to Chierchia (1995a,b), Rooth (1985, 1995), Schubert & Pelletier (1987, 1988), de Swart (1991), Krifka & alii (1995), Krifka (1995)), habitual sentences of the type given in (1) are to be analyzed as relying on quantification over triples of events, individuals, and times:

(1) a. A bird flies
b. A dog barks.

(1^1) a. GENe,x,t (bird (x) $\wedge$ C(e,x,t)) [fly (e,x,t)]
b. GENe,x,t (dog (x) $\wedge$ C(e,x,t)) [bark (e,x,t)]

The corresponding interpretations can be paraphrased as follows: "Take any bird and any situation [event][2] in any world maximally similar to ours where the felicity conditions for flying (such as, e.g., presence of the right triggers) are satisfied [...]. Any bird will fly in such a situation [event]." (Chierchia (1995b: 196)).

Most authors would leave aside the time-variable because it is sometimes argued that this variable coincides with the event-variable. Since I believe that the two variables are distinct (see Section 3 below), and since the time-variable is crucial for the analysis of adverbs of quantification, I have inserted it in the representations above. An LF (Logical Form) in which a time-variable and an event-variable are bound by the same Q-adverb is to be interpreted as corresponding to quantification over *episodic* events, i.e., over events that are individuated relative to time-indices. In case no time-variable is projected (see i-level predicates), the Q-adverb will quantify over *stable*

[2] Although event-based and situation-based accounts are technically different, in many particular cases they coincide in empirical coverage. In this paper, I will use an event-based notation wherever possible, even when reviewing previous proposals (such as Chierchia (1995b)) which, although stated in terms of situations, are not set against the formal background of situation-semantics (Barwise & Perry (1983)).

events (or more precisely, over events that are in a one-to-one correspondence with individuals). The multiple binding of event- and individual-variables notates the fact that individuals covary with events. This co-variation was analyzed in quite different ways by the various available theories of Q-adverbs: the multiple indexing shown in (1^1) may thus be intended as (a) an explicit notation of unselective binding (in the sense of Lewis (1975)) or as (b) iterative/multiple binding (see Chierchia (1995a)) or as (c) selective quantification over events (Rooth (1985, 1995), Schubert & Pelletier (1987, 1988), de Swart (1991), etc) combined with the *indirect* binding (see de Swart's (1991, 1996) *pseudo-binding*) of individual-variables. For my present purposes it is not necessary to distinguish between these various analyses (for further discussion, see Section 3 below). For concreteness, we may assume that the LF's in (1^1) correspond to Chierchia's multiple-binding analysis.

The LF's in (1^1) are problematic insofar as they cannot explain why the following examples cannot be assigned generic readings:

(2) a. * A dog is tired.
b. * A cow is infected.
c. * A fireman is available.

Examples of this kind could, in principle, be analyzed on a par with those in (1), as expressing generalizations over episodic events:

(2^1) a. GENe,x,t (dog (x) $\wedge$ C(e,x,t)) [tired (e,x,t)]

The representations in (1^1) and (2^1) are built on the same model, and as such should be equally legitimate or illegitimate. The grammaticality contrast between the two classes of examples is puzzling.

A further problem is raised by examples of the type shown below, which exhibit the ambiguity glossed in (3)a-b:

(3) A student **rarely** reads novels.
a. '**few** students read novels'
b. 'in general, a student **infrequently** reads novels'

In the (a)-reading, *rarely* (translated as *few*) quantifies over individuals, whereas in the (b)-reading the same Q-adverb has the meaning of a frequency adverb, roughly corresponding to *infrequently*.

This ambiguity cannot be accounted for by assuming the type of LF representation postulated by the analysis under discussion here:

(3′) FEWe,x,t (student (x) ∧ C(e,x,t)) [read novels (e,x,t)]

The interpreation read off this representation would be: few events adequate for novel-reading-by-students are events of novel-reading-by-students. This interpretation corresponds to none of the two intuitive readings of (3) described above, both of which express generalizations over individuals rather than generalizations over episodic events.

1.2 Quantification over individuals

According to an alternative account that is currently available, the examples in (1) are to be represented as relying on generic quantification over individuals:

(1^2) a. GENx (x is a bird) [x flies]

The intuitive motivation for this analysis is the fact that (1)a-b express generalizations over individuals (birds and dogs), rather than over events or situations. LF's of the type shown in (1^2) can be obtained by assuming Diesing's (1992) Mapping Hypothesis, according to which material in (Spec, IP) is mapped onto the restriction of GEN.

This proposal is itself confronted with the problems mentioned above. There is, moreover, another obvious difficulty: s-level predicates necessarily project a time-variable (Kratzer (1988, 1995)), which is not represented in (1^2). Now, if we introduce the time-variable and let GEN bind both variables, we are back at LF's corresponding to quantification over events. If we choose to let GEN bind only the individual-variable, we end up with an illegitimate representation, since the t-variable is left unbound:[3]

(1^2) # GENx (x is a bird) [x flies at t]

1.3 The proposal: quantification over individuals and over times

My analysis will rely on the hypothesis that two default Q-adverbs, rather than just one, are at work, which bind respectively the individual-variable supplied by the indefinite and the time-variable of *fly*:

(1^3) **GEN**x (x is a bird) [**HAB**t [x flies at t]]

[3] Representations of the type in (1^2) would also be illegitimate within the unselective binding hypothesis: although Q-adverbs are allowed to bind indefinitely many variables, the same variables should occur in the matrix and scope.

These two default Q-adverbs carry distinct labels (HAB and GEN, respectively) because they are distinct: they quantify over distinct domains (individuals and times, respectively). The representation in (1^3) also indicates that GEN, which quantifies over individuals is relational/binary, whereas HAB, which quantifies over times, functions as a frequency adverb: it is a unary operator ("weak" in the sense of Milsark (1977)) that applies to an episodic predicate, binds its time-variable, and returns the corresponding habitual predicate. The existence of a silent frequency adverb that is distinct from the relational GEN operator is supported by the systematic ambiguity of overtly realized Q-adverbs: leaving aside some exceptions (e.g., *generally*, which seems to be necessarily relational), Q-adverbs can function either as frequency adverbs or as relational quantifiers (see Section 1.4 below).

Let me now show that the proposal I just made can solve the problems raised above against the two currently available analyses. In order to account for the ungrammaticality of (2)a-c, we must explain why examples of this type cannot be assigned the kind of LF shown in (1^3). In purely descriptive terms, the problem seems clear: the main predicates in (2) cannot be interpreted as habitual (*tired, infected* or *available* cannot be interpreted as meaning 'be regularly tired/infected/available'). This impossibility can be captured by postulating that verbs, but not adjectives,[4] can license the insertion of a default HAB operator. Now, since HAB cannot be supplied, the time-variable will remain unbound, which is illegitimate:

(2′) a. * GENx (dog (x)) [x is tired at t]

If we provide an overt Q-adverb, the examples in (2) become acceptable:

(4) a. A dog is rarely tired.
b. A cow is rarely infected.
c. A fireman is rarely available.

Since the overt Q-adverb can bind the time-variable of *tired/infected/available*, LF's of the type in (4′)a are well-formed:

(4′) a. **GEN**x (dog (x)) **few/infrequently**$_i$ [x is tired at t_i]

Turning finally to the ambiguity shown in (3), it can be accounted for by assuming the LF's in (3′)a-b, each of which rely on a default Q-adverb (HAB and GEN, respectively) that co-occurs with the overt Q-adverb (*rarely*, which translates as *FEW*, may function either as a relational operator or as a frequency adverb). The observed ambiguity is analyzed as a scope-ambiguity:

[4] It may turn out that certain adjectives can take a habitual reading, and conversely, certain s-level predicates cannot. Further investigation is needed here.

(3′) a. **FEW**$_x$ (x is a student) [**HAB**$_t$ [x **reads** novels at t]]
b. **GEN**$_x$ (x is a student) [**FEW**$_t$ [x **reads** novels at t]]

1.4. The two generic operators and the ambiguity of Q-adverbs

In sum, we were lead to postulate the existence of two selective default operators, which are introduced via distinct mapping principles:

(5) a. HAB, which binds a time-variable, is a weak quantifier/unary operator that modifies the predicate.
b. GEN is a binary/relational operator that quantifies over individuals.

This proposal reconciles Carlson's (1977) early view that the generic operator is unary with later analyses, including Carlson (1989), relying on a binary operator. Under my view, these hypotheses are not exclusive of each other, but they are both necessary: as in Carlson's (1977) analysis, the operator that is responsible for the habitual use of s-level predicates is unary. But unlike Carlson (1977), and more in line with later accounts, I assume the existence of a distinct *binary* quantifier, which is responsible for the generic reading of indefinites.

The existence of two distinct generic operators, a unary and a relational one, is strongly supported by the systematic ambiguity of Q-adverbs. As observed by de Swart (1991), most of the overtly realized Q-adverbs, see in particular *rarely, sometimes, usually*, etc. may function either as relational/binary operators or as frequency adverbs, in which case they are to be analyzed as weak/unary operators. Note, however, that according to de Swart, frequency adverbs are irrelevant for the issue of genericity: in generic sentences, Q-adverbs are necessarily to be analyzed as relational operators that quantify over events.

According to the analysis proposed here, a frequency adverb may co-occur with a relational Q-adverb. This view is supported by examples of the type in (6), which contain two overt Q-adverbs:

(6) Generally a student rarely reads novels.
GENx (x is a student) [**FEW**t (x reads novels at t)]

The co-occurrence of two relational Q-adverbs or two frequency adverbs is ruled out by general principles: only one type of constituent is allowed inside the same syntactic domain (functional uniqueness). Other constraints probably exist, which are out of the scope of this paper.

Note, however, that two Q-adverbs need not co-occur: relational and unary Q-adverbs may occur on their own. We thus expect three possibilities: (i) a relational Q-adverb occurring on its own; (ii) a unary Q-adverb occurring on its own; (iii) a relational Q-adverb co-occurring with a unary Q-adverb. The choice between these three logical possibilities depends on various factors, such as the lexical properties of the main verb, the type of DP that constitutes the Topic of the generalization, syntactic properties and information structure. Some of these possibilities will be illustrated in Section 3.5. below.

2 Event-based Representations for Generic Characterizing Sentences

I have so far made an empirical claim: habitual sentences of the type in (1) rely on LF's that contain two, rather than just one Q-adverb. Correspondingly, they express generalizations over individuals (to which a habitual property is attributed), rather than generalizations over episodic events. The next issue is theoretical: how do we represent generalizations over individuals?

2.1 Adverbial Quantification over Individuals

Characterizing sentences built with i-level predicates constitute the simplest possible example of generic sentences expressing generalizations over individuals:

(7) A dog is usually intelligent.
(7′) **GEN**x (x is a dog) [x is intelligent]

Representations such as that in (7′) are in line with the theory of Q-adverbs developed by Lewis (1975), Kamp (1981), Heim (1982), according to which (overt or covert) adverbs of quantification, are *unselective*: they bind all free variables in their domain. In those contexts in which the only available variables are individual-variables, Q-adverbs quantify over individuals.

2.2 Deriving Quantification over Individuals from Quantification over Events

Event-based approaches propose a more constrained theory, according to which Q-adverbs directly/selectively quantify *only* over events or situations (Rooth (1985, 1995), Schubert & Pelletier (1987, 1988), de Swart (1991)). (Generic) quantification over individuals would be derived from (generic) quantification over events (Rooth (1985, 1995) and de Swart (1991, 1996)). A somewhat weaker theory is proposed by Chierchia (1995a,b) and Krifka & alii (1995), Krifka (1995), etc, who assume multiple binding: in addition to binding an event-variable, the Q-adverb may bind one or more individual-variables.

Rooth (1995) tries to demonstrate that the LF in (7′)c, corresponding to quantification over individuals, is to be derived from the more basic LF given in (7′)a, in which the Q-adverb quantifies over events. In (7′)a-c I have preserved, with slight modifications, Rooth's notation. Although Rooth's LF's do not contain event-variables, they notate quantifications over events, because the restriction contains a propositional constituent:

(7′) a. usually (a dog (x) ∧ x has some property) [a dog(x) ∧ x is intelligent]
b. usually (a dog (x)) [a dog(x) ∧ x is intelligent]
c. usually (a dog (x)) [x is intelligent]

According to Rooth, the LF in (7′)a is obtained by assuming that: (i) the whole sentence goes to the matrix of *usually*; (ii) the restriction is filled with the focus closure of the matrix: since in this case the focused constituent is the VP, the focus closure is an existentially closed variable over properties, which in informal English can be paraphrased as "has some property". Since "having some property" is a trivial condition on the variable, it can be suppressed, which allows Rooth to derive (7′)b. Finally, (7′)b reduces to (7′)c due to the semantics of one variant of the DRT model.

De Swart (1996) follows Rooth in assuming that Q-adverbs basically quantify over events, but according to her, quantification over individuals is not represented at LF, but only constitutes a pragmatic inference for those examples in which there is a one-to-one mapping between events and individuals.

Going back to the habitual characterizing sentences examined in Section 1 above, it should be clear that the analysis proposed there can be restated within an event-based framework: the habitual predicate *habitually read novels* (relying on a default HAB operator) would constitute the matrix, and a corresponding "trivial" property would go to the restriction:

(7[3]) **FEWx** (student (x))) $\wedge$ x has some property that is suitable for habitually reading novels)
[x **HAB**-reads novels]

Since events of habitually reading novels are in a one-to-one relation with individuals that habitually read novels, the overt Q-adverb ends up quantifying over individuals (either at LF or in the pragmatic component, depending on whether we adopt Rooth's or de Swart's implementation). It thus seems clear that the co-occurrence of two Q-adverbs proposed in Section 1 above is independent of whether we choose to represent generalizations over individuals as relying on quantification over individuals or over (stable) events.

2.3 Mapping Rules for Q-adverbs occurring in Topic-Comment generic sentences

Let us now examine the syntax-LF mapping rules underlying event-based accounts. The question that is relevant here is whether Rooth's (1985, 1995) association-with-focus theory can be assumed to apply in examples such as (7). Let us first illustrate Rooth's theory with an example for which it was specifically designed. The capitalized constituents carry contrastive focus:

(8) a. In St. Petersburg OFFICERS always escorted ballerinas.
b. In St. Petersburg officers always escorted BALLERINAS.

These two examples express different generalizations because, due to different focus-assignments, the restriction of the quantifier is different: (8)a means that whenever ballerinas were escorted, it was by officers, whereas (8)b means that whenever officers escorted someone, they escorted ballerinas. This difference in interpretation can be captured by assuming the LF's in (8′):

(8′) a. $\text{always}_{e,x,y}$ (escort (x,y,e) $\wedge$ ballerinas (y)) [escort (x,y,e) $\wedge$ officers (x)]
b. $\text{always}_{e,x,y}$ (escort (x,y,e) $\wedge$ officers (x)) [escort (x,y,e) $\wedge$ ballerinas (y)]

The LF's in (8′)a-b can be obtained by Rooth's mapping principles: the restriction is filled with the *focus closure* of the matrix, which is obtained by replacing the focused constituent with a variable.

Let us now go back to our question: should we assume that the association-with-focus theory also applies to examples such as (7), repeated here:

(7) A dog is usually intelligent.

Rooth's argument in favor of subsuming characterizing sentences under his association-with-Focus theory is that Rhematic Focus constitutes a particular type of Focused constituent. One can however argue against identifying the two types of Focus: contrastive Focus introduces a set of event-alternatives, whereas Rhematic Focus introduces new information without presupposing alternatives to it.

Rooth (1995) himself acknowledges that no compelling evidence exists in favor of applying the association-with-focus theory to examples such as the one in (7). We may instead assume the Mapping Rule in (9). For my present purposes, it is not necessary to choose between the two versions of (9) given in (i)-(ii): the examples under examination are built with preverbal subjects, which go to the restriction on either (9)i or (9)ii (The difference between the two rules becomes relevant for those sentences in which the Topic is an element other than the preverbal subject).

(9) (i) Material in (Spec, IP) goes to restriction of Q-adverbs (Diesing (1992))
(ii) Topic DPs go to the restriction of Q-adverbs (Partee (1995)).

By applying either one of these rules, we derive LF representations in which the Q-adverb quantifies over individuals, *not* over events.

2.4 Asymmetric readings of if/when-clauses

Following Lewis (1975), it is currently assumed that *if/when*-clauses are mapped onto the restriction of the Q-adverb, and the main clause goes to the matrix. Since sentential constituents may be analyzed as denoting sets of events, the Q-adverb may be assumed to quantify over events. This analysis can be stated within generalized quantifiers theory (de Swart (1991, 1996)): the Q-adverb denotes the relation between the sets of events (notated as lambda-abstracts over events in (10)c and (11)c) denoted by the *if*-clause and the main clause, respectively. In order to avoid taking an explicit stand regarding the way in which the individual variables corresponding to event-participants are bound, I have slightly modified de Swart's (1996) representations: instead of assuming a dynamic existential quantifier that binds individual-variables, I assume that event-participants are introduced as the values of functions from events to individuals. The relevant functions correspond to the various th-roles,[5] the exact labels of which are irrelevant here:

(10) a. If a woman has a cat, she usually likes it.
b. USUALLY (a $woman_i$ has a cat_j) [she_i likes it_j]
c. USUALLY (λe have (e) ∧ woman (Th-role1 (e)) ∧ cat (Th-role2 (e))) [λe like (e)]

(11) a. If a drummer lives in an apartment building, it is usually empty.
b. USUALLY (a drummer lives in an apartment $building_i$) [it_i is empty]
c. USUALLY (λe live in (e) ∧ drummer (Th-role1 (e)) ∧ ap. build. (Loc (e))) [λe empty (e)]

The LF in (10)c tells us that *USUALLY* denotes the relation between the set of events of possession in which the Possessor is a woman and the Possessed is a cat and the set of events of liking (that have the same participants). This LF, just like the one in (11)c, corresponds to a symmetric reading: (10)c says that most events in which a possession relation holds between a woman and a cat are events in which a liking relation holds; similarly, the LF in (11)c says that most of the events in which a drummer lives in an apartment building are events in which the apartment building is empty. These LF's are problematic, since they do not correspond to the intuitive readings, which are asymmetric: the Q-adverb quantifies over women who own cats and over apartment buildings in which drummers live, respectively. In order to account for asymmetric readings, we must assume that only some of the indefinites occurring in the restriction of a Q-adverb get bound by it (see *a woman* and *an apartment building* in (10) and (11), respectively). Most theorists suggest that in order for an indefinite to get bound by the Q-adverb, it must be a Topic (see Chierchia (1995a,b) and de Swart (1996)). But we are then lead to conclude that Q-adverbs do not quantify exclusively over events, but rather over pairs of events and individuals. The LF's in (10)d and (11)d can be obtained by assuming the Coindexing algorithm and the Mapping rules proposed by Chierchia (1995a), who allows Q-adverbs to bind several variables (multiple binding):

(10) d. $\text{USUALLY}_{e,x}$ (have (e,x) ∧ woman (x) ∧ cat (Th-role2 (e))) [like (e)]
(11) d. $\text{USUALLY}_{e,y}$ (live in (e, y) ∧ drummer (Th-role (e)) ∧ ap. building (y)) [be empty (e)]

De Swart (1996) attempts to avoid multiple binding and to maintain the more

[5] This type of notation is currently used in some of the neo-Davidsonian approaches:
(i) λxλy∃e (write (e) ∧ Agent (e,x) ∧ Theme (e, y) ∧ Loc (e, t))
(ii) λxλy∃e (be intelligent (e) ∧ Theme (e, x)).
In (i)-(ii), the main predicate is analyzed as a property that restricts an event-variable; the arguments and the modifiers of the predicate are introduced as functions from events onto objects. The values of these functions can be identified with particular individuals: Agent (e,x) is to be read as "the Agent of e is x". But they can also be left unspecified: thus, in (10) and (11), the indefinites do not supply individuals, but merely a property that restricts the range of the value of the function: *woman (Th-role1 (e))* is to be read as "the first argument of the event (of possession) is a woman".

constrained view that Q-adverbs can quantify *only* over events. She treats indefinites as dynamic existential quantifiers, but she is nevertheless forced to assume that the indefinites that constitute the Topic of the generalization ("in the sense that the generalization expressed by the sentence is 'about' that NP" (de Swart (1996:182)), are subject to a particular treatment: they are formally speaking existential quantifiers, but they get "pseudo-bound" by the Q-adverb. But we must then assume some (secondary) indexing that notates pseudo-binding. Once this mechanism is explicitated (which de Swart did not do), it will probably turn out to be quite similar to Chierchia's multiple binding, which in fact undermines the hypothesis that Q-adverbs quantify *only* over events.

We are thus lead to conclude that any analysis of Q-adverbs must resort to quantification over individuals. The next question to be examined is whether quantification over events is at all necessary.

3 Adverbial quantification without event-variables

In what follows I will reject the hypothesis that event-variables are necessarily projected in the argument-structure of sentential predicates. I will then show that within such a framework, Q-adverbs can be analyzed as quantifying over (i) individuals (or tuples of individuals), (ii) times or (iii) tuples of times and individuals.

3.1 Event-variables are not part of the argument-structure of predicates

The view that event-variables are not part of the argument-structure of predicates is supported by an obvious syntactic observation: no syntactic position can be identified as corresponding to the event-variable. Note furthermore that there is a peculiar restriction on event-variables: with run-of-the-mill predicates, the e-variable must be assumed to be necessarily bound by existential closure:

(15) Mary was angry yesterday.

(15′) ∃e angry (e, Mary, yesterday)

Compare predicates that subcategorize for sentential complements:

(16) It annoyed/disturbed me that he came home so late.

In examples of this type, the main predicate must be assumed to have two event-variables, an "external" one (bound by existential closure) and an "internal" one, which is saturated by the embedded clause:

(16′) $\lambda e_2\ \exists e_1$ (annoyed/disturbed $(e_1, x, e_2) \wedge x = I$) (that he came home so late)

Given the peculiar behavior of external e-variables, we may want to assume a more canonical argument-structure, which contains individuals, time-, space-localizers, as well as "internal", but no "external" event-variables. Sentences are composed in the standard way, by saturating the argument-slots of the predicate.

Under this view, however, we seem to lose the explanations proposed by Davidson (1967) and Parsons (1990) for the entailments triggered by modifiers. I believe that it is possible to meet both ends by assuming type-shifting rules of the kind in (17), which apply only if P is a sentential predicate:

(17) a. $\exists x\ P(x) \Rightarrow \exists e,x\ P(e,x)$
b. $\lambda x\ P(x) \Rightarrow \lambda x\ \exists e\ P(e,x)$

These type-shifting rules allow us to reconcile the syntactic level of representation (at which no external event-variable is introduced) with the necessity of accounting for Davidsonian entailments.

3.2 If/when-*clauses: adverbial quantification over individuals*

I will now attempt to show that it is possible to account for adverbial quantification without using e-variables. In other words, the type-shifting rules introduced above are not needed for the analysis of Q-adverbs, although they may well be useful for other phenomena. I will start with *if/when*-clauses, which constitute the paradigmatic example of quantification over events, and I will argue that even in this case, the Q-adverb can be analyzed as quantifying over individuals.

As already discussed in Section 2.4 above, the asymmetric readings of *if/when* clauses can be accounted for only if we assume that Q-adverbs bind, in addition to the event-variable, only one of the individual-variables occurring in the restriction. Here, I will argue that binding the event-variable is not needed: binding one of the individual-variables is sufficient. But which variable? According to both Chierchia (1995a,b) and de Swart (1996), Q-adverbs bind (or merely "pseudo-bind", as argued by de Swart

(1996)) the variable supplied by the Topic, but it is left implicit whether it is the Topic of the restriction or the Topic of the matrix that is relevant. Since it is the restriction that supplies the domain of quantification, one might be tempted to believe that it is the Topic of the restriction that gets bound by the Q-adverb. It seems however clear that what matters is the Topic of the matrix. The most obvious argument in favor of this assumption is the fact that the Q-adverb has widest scope, hence it takes scope over the matrix, and presumably binds the highest argument in that domain:

(18) A Q-adverb binds the variable supplied by the Topic of the Matrix.

Now, if the restrictor contains variables that are coindexed with the variable supplied by the Topic of the matrix, the Q-adverb will end up binding those variables also. By applying this procedure to our examples, we obtain the tripartite configurations shown in (10)e and (11)e, in which *usually* translates as MOST. The analysis of the dependant indefinite and of the corresponding donkey-pronoun is out of the scope of this paper. For concreteness, I will assume that the dependent indefinite is to be represented as an existentially closed function-variable (see Comorovski (1999)) that applies to the individual variable that is bound by the quantifier and yields an individual that ranges over the set denoted by the nominal predicate contained in the dependent indefinite (for the examples under discussion here, the values of the relevant functions range over cats and drummers, respectively):

(10) e. $MOST_x$ ∃f (x has f(x) ∧ woman (x) ∧ cat (f(x))) [x likes f(x)]
(11) e. $MOST_x$ ∃f (f(x) lives in x ∧ apartment building (x) ∧ a drummer f(x)) [x is empty][6]

According to these LF's, the Q-adverbs quantify over arguments of sentential predicates, which corresponds to quantifying over event-participants: "most of the individuals who have a cat (and are women) are such that they like that cat"; "most of the places (that are apartment buildings) in which a drummer lives are such that they are empty".

In sum, I have adopted a framework which dispenses with event-variables. Sets of event-participants can be obtained by abstracting over one of the argument-positions of

[6] These tripartite configurations can be translated in terms of generalized quantifier theory: the Q-adverb is analyzed as denoting the relation between two sets of entities, which are obtained by abstracting over the variables that are bound by the quantifier:
(10) f. MOST ∃f (λx (x has f(x) ∧ woman (x) ∧ cat (f(x))) [λx (x likes f(x)]
(11) f. MOST ∃f (λx (f(x) lives in x ∧ apart. building (x) ∧ a drummer f(x))) [λx (x is empty)]

a sentential predicate. "Adverbial quantification over events" is an improper label for a relation that is to be represented as quantification over event-participants. More precisely, the relevant type of LF is one in which the Q-adverb binds an individual-variable, and the restriction contains a sentential predicate. Representing quantification over events as quantification over event-participants (arguments of sentential predicates) seems adequate not only because the asymmetric readings of *if/when*-clauses can be accounted for, but also on more general grounds: it is indeed well-known that events can be individuated only if they are relativized to individuals (or to times). In other words, strictly speaking, it is not possible to count or to quantify over events: we can only count and quantify over event-participants (or times at which an event takes place).

3.3 If/when-clauses: adverbial quantification over times

Let us now consider *if/when*-clauses that contain s-level predicates:

(19) When it rains, I stay home.

Following Kratzer (1988, 1995), I will assume that s-level predicates necessarily project a time-variable,[7] which cannot remain free. If it is not assigned a particular index, a time-variable gets bound by the closest Q-adverb:

(20) If a free time-variable occurs in the scope of a Q-adverb, it gets bound by it.

We thus derive the LF in (19′):

(19′) GEN_t (it rains at t) [I stay home at t]

According to this representation, the Q-adverb quantifies over times: (19′) is interpreted as saying that most of the times at which it rains are such that I stay home at those times. This corresponds to quantifying over events that are individuated relative to times.

Other examples are somewhat more complex:

(21) If a bishop meets a sinner, he rarely blesses him.

[7] As discussed in the Appendix below, the arguments raised against Kratzer's (1988) proposal do not really affect the core of her generalization.

(21′) $\mathbf{FEW}_{x,t}$ $\exists\mathbf{f}$ (x meets f(x) at t $\wedge$ bishop (x) $\wedge$ sinner (f(x))) [x blesses f(x) at t]

Representations of this type, in which the Q-adverb binds a pair of an individual- and a time-variable, are to be interpreted as quantifications over stages of individuals, or more precisely over arguments of s-level predicates: (21′) is interpreted as saying that few of the individuals (that are bishops) who meet a sinner at t are such that they bless him at t.

3.4 Characterizing sentences: adverbial quantification over individuals

Let us consider next characterizing generic sentences, i.e., monoclausal generic sentences that have a Topic-Comment configuration:

(22) A cat is usually intelligent.

Just like in generic *if/when*-clauses, the Q-adverb will bind the variable supplied by the Topic. There is, however, a crucial difference between *if/when*-clauses and generic sentences of the type in (22): in the latter case there is no pre-existant bipartition into a Restrictor and a Matrix. More precisely, the overall sentence belongs to the Matrix, but there is no syntactically-defined Restrictor. We therefore need a further Mapping Rule. The reader may choose between (9)i or (9)ii, repeated here as (23)i-ii:

(23) i. Material in (Spec, IP) goes to restriction of Q-adverbs (Diesing (1992))
ii. Topic DPs go to the restriction of Q-adverbs (Partee (1995)).

We can thus obtain the LF in (22′):

(22′) USUALLY_x (cat(x)) [x is intelligent]

Nominal predicates denote *event-independent* sets of individuals such as students, cats, etc. This type of domain of quantification crucially differs from the one that characterizes *if/when*-clauses: in the latter case, the Q-adverb quantifies over arguments of sentential predicates, which are interpreted as event-participants. Thus, although formally speaking, the Q-adverb quantifies over individuals in both types of generic sentences, the domains of quantification are radically different, due to the different types of restrictions (nominal vs sentential predicates). Correlatively, I propose to distinguish between two types of generic indefinites:

(24) a. An indefinite takes a "truly" generic reading if it is selectively bound by a Q-adverb. (the restriction is filled with a nominal predicate). See (22).
b. An indefinite takes a pseudo-generic reading if it is indirectly bound by a Q-adverb that binds the argument-variable of a sentential predicate. See (10), (11), and (21).

3.5 Habitual sentences

In the previous section we have examined monoclausal generic sentences built with i-level predicates. Such sentences are of necessity *characterizing*, in the sense that they necessarily rely on quantification over individuals, and correspondingly are interpreted as expressing generalizations about (*event-independent) individuals*.

Monoclausal generic sentences built with s-level predicates are more complex, because of the presence of the time-variable projected by such predicates. Such sentences may be assigned distinct representations, depending on whether they rely on the occurrence of two Q-adverbs or on just one of them.

The first possibility is to let the time-variable and the individual-variable be bound by distinct operators. This option, which has already been exploited in Section 1 above, underlies *habitual characterizing sentences* (e.g., *A bird flies, A dog barks*), i.e., generic sentences that attribute a *habitual property* (derived by applying a unary Q-adverb, in particular HAB, to an s-level predicate) to individuals (generalizing over individuals relies on a binary Q-adverb).

It is however *not* necessary to supply two Q-adverbs: a relational quantifier is needed only in those configurations that rely on some kind of bipartition, in particular the one induced by a Topic-Comment split. Consider instead thetic sentences (sometimes referred to as *all-Focus* configurations):

(25) a. A cow is rarely infected on this farm.
b. A fireman is rarely available in this town.

In such sentences, *rarely* can be analyzed as a frequency adverb binding the time-variable; the individual-variable supplied by the indefinite subject can be assumed to be bound by existential closure:

(25′) $\mathbf{FEW}_t\ \exists x\ [x \text{ is a cow} \wedge x \text{ is infected at } t \text{ on this farm}]$

These LF's are interpreted as asserting the infrequent occurrence of events of cow-infection or fireman-availability.

There is yet a third possibility of analyzing monoclausal habitual sentences: only a relational Q-adverb is at work, which binds both the time- and the individual-variables. Note now that quantifying over pairs of individuals and times is equivalent to quantifying over time-indexed individuals (stages of individuals). It is, however, plausible to assume that a relational quantifier cannot quantify over stages of individuals because of the structure of this domain: just like the domain of times, the domain of stages of individuals is ordered by the part-whole relation, which means that the elements of this domain are not individuated, and as such cannot be counted. We may further conjecture that adverbial quantification over stages of individuals is possible only if the restriction contains an event-predicate. The Q-adverb thus ends up quantifying over event-participants rather than over event-independent individuals. Some nominal modifiers, e.g., gerunds, may provide the necessary event-predicate:

(26) An elephant walking in the middle of the street has always caused curiosity.
(26′) GENx,t (x is an elephant and x is walking .. at t) [x has caused curiosity at t]

In other monoclausal configurations, there is no overt event-predicate that could go to the restriction. It is however possible for the restriction to be filled with a sentential constituent that can be inferred from the overt sentence. One possibility is Rooth's (1985, 1995) association-with-focus theory, which applies in those sentences that contain a contrastively focused constituent (see examples (8)a-b above). Another mapping rule was proposed by Schubert&Pelletier (1987, 1988), who assume that the restriction is filled with the presupposition of the matrix:

(27) a. A cat lands on its feet.
b. Three chatter-boxes won't travel long together.
c. A u usually follows a q.
(27′) a. ALLx,t (x is a cat and x falls to the ground at t) [x lands on its feet at t]

We have thus reached the conclusion that certain monoclausal generic sentences are indeed comparable to *if/when*-clauses, insofar as they rely on an LF characterized by a restriction that contains a sentential predicate. Correspondingly, such sentences are interpreted as quantifying over event-participants. This is, however, only one of the three possible representations of generic monoclausal sentences.

Conclusions

The main purpose of the presentation above was to establish the basic types of LF representations for sentences containing Q-adverbs. We saw that Q-adverbs can be either analyzed as relational/binary operators or as frequency adverbs, in which case they function as unary operators that bind the time-variable of s-level predicates. Frequency adverbs may occur on their own, as in habitual existential sentences, or they may co-occur with relational Q-adverbs, as in habitual characterizing sentences. Relational Q-adverbs may quantify either over event-independent individuals (as in characterizing sentences) or over event-participants. The latter possibility underlies *if/when*-clauses, as well as those monoclausal generic sentences in which the restriction of a relational Q-adverb is filled by a sentential predicate (as a result of Mapping Rules that take into account contrastive Focus or presuppositions).

Appendix: event-variables and time-variables

According to Kratzer (1988, 1995), the difference between i(ndividual)-level/stable and s(tage)-level properties (see *intelligent* and *invite*, respectively) can be characterized in terms of the lack vs the presence of an argument for spatiotemporal location (a localization-variable). Despite Kratzer's own (1988, 1995: 126) view, the localization-variable characteristic of s-level predicates should not be identified with the Davidsonian event-variable, which can be postulated for any kind of predicate, including i-level predicates (see Chierchia (1995)). We may instead assume that the relevant difference between s-level and i-level predicates is the presence of a time-variable. The necessary distinction between event-variables and time-variables is obvious as soon as we consider their syntactic status: locations clearly constitute syntactic constituents, which occupy syntactic positions. No such position can be postulated for event-variables, which as such have no syntactic status.

Let us then consider the hypothesis that only s-level predicates project time-variables. This characterization itself was further refined by de Swart (1991), who observed that i-level predicates do have time-variables (e.g., *when he was a child, John was blond),* which are however peculiar insofar as they can receive only one value (relative to the same individual). In other words, the real difference between i-level and s-level predicates is that the former carry a uniqueness presupposition: an i-level predicate can apply only once to the same individual, whereas s-level predicates apply recurrently to the same individual. This characterization allows de Swart to explain why i-level predicates behave on a par with *once-only* predicates that are clearly s-level (*die, build the house of Mary, write Liaisons Dangereuses*). This uniqueness presupposition (in more simple terms, the fact that the time-variable cannot be assigned more than one value relative to the same individual), which characterizes i-level and once-only predicates alike, explains why the time-variables of such predicates cannot be bound by a Q-adverb: quantification can only apply to a domain that contains at least two entities (the plurality constraint on quantification). S-level predicates satisfy the plurality constraint regardless of whether the DPs occurring in the restriction introduce variables or constants: in *Mary rarely reads novels when she is tired*, the Q-adverb counts the number of times at which Mary reads novels. The relevant domain contains more than one time-index, simply because *read novels* may recurrently apply to Mary. The time-variable of i-level predicates, on the other hand, cannot satisfy the plurality constraint on quantification, which means that it cannot be bound by a Q-adverb. In other words, an example such as **Mary is rarely tall* is ruled out by the plurality constraint on quantification rather than by the lack of a time-variable: for predicates such as *tall*, there is only one time-value for each assignment to an individual, and hence the time-variable cannot provide a domain for the Q-adverb to quantify over.

In sum, de Swart's revision of Kratzer's definition says that once-only predicates (including i-level predicates) cannot supply a time-variable for the Q-adverb to bind. This revision does not affect Kratzer's claim that whenever the main predicate is i-level, the Q-adverb is forced to quantify over individuals (recall that I have demonstrated above that we need not assume that Q-adverbs quantify over events).

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