

ON FREQUENCY ADJECTIVES¹

Abstract

Frequency adjectives like *occasional* can occur, unexpectedly, in connection with nouns which do not denote events: *Agent Cooper likes an occasional cup of coffee*. I provide a full classification of these adjectives and formulate a solution in terms of event semantics which keeps the core semantic contribution of frequency adjectives constant for normal uses and such marked uses with non-event nouns. This distinguishes my approach from previous approaches which are merely partial and use non-standard ontologies and semantics for the marked constructions.

1 The Problems with Frequency Adjectives

Events can have frequencies with which they occur, but non-event objects lack the required temporal properties to be attributed a frequency. Thus, modification of an event noun by a frequency adjective is as unproblematic as modification of a verb by a frequency adverb:

- (1) a. Noam holds a yearly lecture on good and evil.

However, the following sentences are fine in English. The first one is a generic statement, the second one allows a paraphrase including the adverbial *occasionally*:

- (2) a. Agent Cooper likes an occasional cup of coffee.
b. Agent Cooper drinks an occasional cup of coffee.

These sentences look like a frequency is attributed to a cup of coffee, which is not plausible ontologically. Once more, the two cases seem to be quite different. For example, the former is restricted to kind level NP positions, the second one to individual level positions. Previous accounts (cf. section 3) have only discussed one of these two marked cases, or even just the second one, and they have produced analyses under which both marked readings differ from each other significantly, and from the unmarked cases. In this paper, I follow the intuition that all uses of frequency adjectives involve the same core semantic contribution, namely some form of frequency quantification over events. A thorough classification of all sorts of frequency adjectives in all sorts of readings is therefore required.

The paper is structured as follows: First, I provide a full classification of frequency adjectives, their environments, and their readings in section 2. Then, I briefly sum up previous approaches, pointing out their incompleteness and their strengths in section 3 before presenting my own solution in section 4.

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2 A Full Classification

2.1 Three Readings

First of all, we have to distinguish three relevant readings (cf., e.g., (Stump 1981)): internal reading, generic reading, and adverbial reading.

Although the **internal reading** is usually ignored in the literature (probably as trivial), it is in the spirit of the current approach to search for a unified representation of meaning for frequency adjectives in every existing reading. The **internal reading** occurs, as in (3), with agent nominalizations and informs the hearer about the frequency with which an agent performs the action denoted by the nominalized verb.

(3) A frequent liar told Agent Cooper a story.

The **generic reading** also relates an event to a frequency, cf. (4). The meaning of the resulting (kind level) NP seems to be resolvable within the NP with the adjective temporally quantifying over N-events (for any noun N). For the so-called **adverbial reading**, however, a paraphrase containing an adverbial is appropriate (cf. (5)), allegedly making it necessary for the adjective to be semantically active outside of the nominal domain containing it.

(4) A daily walk is good for your health.
 ≠ Daily, a walk is good for your health.

(5) An occasional sailor strolled by. ⇔ Occasionally, a sailor strolled by.

2.2 Cooccurrence with Types of Nouns

Let us now check with which kinds of nouns the readings occur. First of all, with event nominals such as *walk*, the generic reading is exclusive, cf. (6). With agent nominals like *liar*, the internal reading is strongly favored as in (7), but the adverbial reading and generic reading seem to be available in the appropriate contexts and given the right lexical choices (cf. (8)).

(6) Agent Cooper likes a daily walk.

(7) Agent Cooper hates occasional liars.

(8) Agent Cooper interviews/likes occasional liars.

a. ⇔ Occasionally, Agent Cooper interviews a liar. (adverbial reading)

b. ⇔ Agent Cooper likes to be occasionally involved in some event with a liar. (generic reading)

As mentioned, frequency adjectives occur with nominals which are not in any way event-denoting. Non-event nouns like *cup of coffee* are compatible with both the adverbial reading and the generic reading, as demonstrated in (9) and (10). Notice that the generic reading is restricted to kind-level argument positions (cf. Stump (1981) and Carlson (1977) or Krifka, Pelletier, Carlson, ter Meulen, Chierchia and Link (1995) for the underlying ontological theory). Of course, lexical choice plays a major role in the acceptability of the sentences.

(9) Agent Cooper drinks an occasional cup of coffee.

(10) A frequent cup of coffee keeps Agent Cooper awake.

2.3 Three Semantic Classes

Let me make some remarks on the different semantic classes of frequency adjectives. First of all, there are **absolute frequency adjectives** like *yearly* which are fine in any reading besides the adverbial reading with non-event nouns, cf. (11). The remaining cases of adjectives specifying relative frequencies split into **relative frequency adjectives** and **relative infrequency adjectives**. Relative frequency adjectives like *frequent* also occur in all readings except in adverbial reading with non-event nouns, cf. (12). **Relative infrequency adjectives** (which specify frequencies perceived as low) like *occasional* are fine in any reading, cf. (13).

- (11) a. A daily cup of coffee helped Sheriff Truman stay awake.
 b. We hold a yearly convention.
 c. He is a daily runner.
 d. *Agent Cooper solved a yearly murder.
- (12) a. A frequent cup of coffee helped Sheriff Truman stay awake.
 b. We hold a frequent convention.
 c. He is a daily runner.
 d. *Agent Cooper solved a frequent murder.
- (13) a. An occasional cup of coffee helped Sheriff Truman stay awake.
 b. We hold an occasional convention.
 c. He is an occasional runner.
 d. Agent Cooper solved an occasional murder.

Notice that one important semantic property which distinguishes relative frequency adjectives and relative infrequency adjectives is that the former are sensitive to the context as well as verbal and nominal parameters in the sentence. In other words, what counts as *frequent* etc. can be quite diverse, as demonstrated in (14). This point has to be taken into account for model-theoretic solutions.

- (14) a. During several Billion years, frequent mergers of galaxies took place.
 b. In the plasma, a frequent change of the ions location was observed.

As a final note, let me point out that the distinction between relative frequency adjective and relative infrequency adjective might not be so clear, as some native speakers have recently informed me.¹ In (15), for example, we are clearly dealing with an adverbial reading (the paraphrase test is successful), but *regular* can by no means be classified as specifying low frequency.

- (15) At work, most agents of the Bureau drink their regular cup of coffee.

This concludes the cross-classification of frequency adjectives along (hopefully) all relevant dimensions. In the next subsection, I will discuss some additional constraints related to the linearization and coordination of frequency adjectives as well as restrictions on the choice of the determiner for NPs containing a frequency adjective.

¹I would like to thank the Barcelona audience for valuable comments on this matter.

2.4 Linearization, Coordination, Determiner Selection

Frequency adjectives show a complex linearization behavior w.r.t. other adjectives. With all nouns but agent nominals (internal reading), they precede other adjectives: (16). Even with intensional adjectives such as *alleged*, no other linearization occurs, mainly because these seem to be incompatible with frequency adjectives anyway (cf. (17)). With agent nominals, however, the exact reverse order is required: The frequency adjective has to be adjacent to the noun (as in (18)).²

- (16) *Agent Cooper likes a hot frequent cup of coffee.
- (17) a. ? Agent Cooper drinks a frequent imaginary cup of coffee.
b. *Agent Cooper drinks an imaginary frequent cup of coffee.
- (18) a. Laura was a beautiful frequent liar.
b. *Laura was a frequent beautiful liar.

Coordination with any other adjective is impossible (cf. (19)) which all in all allows the conclusion that the adjectives under discussion form their own subclass.

- (19) a. *... a strong and occasional cup of coffee ...
b. *... an alleged and frequent flyer ...

Finally, I want to point to the fact, discussed in Zimmermann (2003), that NPs with frequency adjectives in the generic reading or the adverbial reading occur only with a small set of determiners, viz. *a*, *the* and *a* (in Zimmermann's words) "bleached" version of *your*. This is true whether the NP contains an event noun or a non-event noun. As far as I can see, this selection should be extended to other "bleached" possessive pronouns, as was already demonstrated by (15).

2.5 German vs. English

To determine the relative markedness and inter-language variability of the available readings, I now provide a short comparison of English with German.

Of special interest here are the marked cases with non-event nouns and a frequency adjective. Comparing English and German data, we found that German seems to be much less open to that construction. A corpus pre-study on the first one thousand hits for *gelegentlich* (occasional) gave us over 99% with event nominals. Among the remaining hits with non-event nouns were some which were clear cases of generic readings, mostly in headlines and non-integrated NPs, cf. (20). There was no single occurrence of a normal sentence containing an NP in the generic or adverbial reading.

²(18-b) could be judged as acceptable under a very different interpretation. In that case the interpretation would give further information on the manner of the lying. Such uses of adjectives were discussed by, among others, Chierchia (1995) and Larson (1998). My analysis to be laid out in section 4 could in principle account for such cases and the linearization phenomena.

- (20) a. Gelegentliches mobiles Internet
occasional mobile internet
'occasionally used mobile internet'
- b. ein gelegentliches Problem mit dem Modem
an occasional problem with the modem
'a problem with the modem which occurs occasionally'

Turning to native speaker judgements, the adverbial reading with non-event nouns as in (21) was generally rejected as bad, at least it was judged as significantly worse than in English.

- (21) a. *Inspektor Derrick trinkt eine gelegentliche Tasse Kaffee.
inspector Derrick drinks a occasional cup coffee
'Inspector Derrick drinks an occasional cup of coffee.'

I take these facts to indicate that the adverbial reading is not available at all in German, and that the generic reading is marginally acceptable but not preferred.

3 Previous Approaches

3.1 Complex Quantifiers

I will now discuss the directions which previous analyses have taken to explain for the strange fact that a non-event noun can be modified by an adjective which by its normal semantics should modify event-denoting nouns only.

Larson (1998) only marginally touches on the problem, discussing only the adverbial reading. In Larson's analysis, the frequency adjective undergoes a movement operation on the way to LF: It adjoins to the determiner and forms a complex quantifier quantifying over tuples of events and non-event individuals which then undergoes quantifier raising. The actual determiner (*a*, *the*) is thus syncategorematic. See (22), where the relevant interpretation of the complex determiner is also given.

- (22) a. $[[DP [D [occasional] an] sailor]_i [IP t_i strolled by]]$
b. $INFREQ\langle e, x \rangle [\Pi(e, e^*) \wedge sailor(x)] [strollingby(e, x)]$
where $\lambda e. \Pi(e, e^*)$ is a function from an event e to *true* iff e is part of a contextually given event e^*

Larson's approach obviously does not explain how frequencies are calculated but assumes simple quantification over events in part-of structures. Imagine, however, a situation where during one evening three sailors strolled by, all of them at 8:00. In terms of Stump (1981), the events have clumped (cf. subsection 3.2), and the sentence *An occasional sailor strolled by.* would be false in that case. Larson's LF, however, would be evaluated as true. Furthermore, the solution does not generalize to the other readings. Finally, the non-canonical raising operation would only be required with non-event nominals, actually requiring one version of INFREQ which quantifies over tuples and one which quantifies over simple events.

3.2 Event Clumping

Zimmermann (2003), who also deals mainly with the adverbial reading, makes an attempt to solve the problem of event clumping mentioned above by hard-coding the requirement that there be a certain time interval between any two of the events quantified over by INFREQ. Formulated

in terms of a constrained event structure following Lasersohn (1995), the semantics of INFREQ according to Zimmermann is given in (23). The boldprinted condition is the one relevant to the present discussion. Again, the actual determiner is syncategorematic.

$$(23) \quad [INFREQ\langle e, x \rangle] = \lambda Q \lambda S. \exists \langle e, x [partof(e, e^*) \wedge Q(x)] : S(e, x) \wedge \\ \forall \langle e', x' \rangle, \langle e'', x'' \rangle [S(e', x') \wedge S(e'', x'') \wedge Q(x') \wedge Q(x'')] : \\ ((e' = e'') \vee (e' \neq e'' \wedge \exists \mathbf{t} [\mathbf{between}'(\mathbf{t}, (\tau(e'), \tau(e'')))])))]$$

This is a promising idea. However, imagine the following situation: During some night, five sailors strolled by, one at 8:12, one at 9:34, two simultaneously at 10:05, one at 11:58. Intuitively, we want the sentence *Occasionally, a sailor strolled by.* to be true in that world. Solving the problem of clumping by strictly requiring intervals in between events seems to avoid clumping too strictly. What this indicates is that there is probably no satisfactory solution based on predications about individual events in relation to other individual events (with or without inclusion in a part-of structure). A certain amount of clumping **is** allowed, and the overall randomness of the distribution is what characterizes the contribution made by the frequency adjective. In 4.2, I suggest a balanced solution.

3.3 Surveys and Kinds

To my knowledge, the most comprehensive look at frequency adjectives is Stump (1981). Stump analyzes both the generic reading and the adverbial reading, but gives them entirely different semantic content. First, to render the adverbial reading (compare again (5)), the concepts of *Survey* and *Sub* (subsurvey) and a constant random interval j over the set of instants are introduced. The *survey* of a property, a function from individuals to time intervals, is a secondary notion parasitic on the normal semantics of propositional temporal operators like *Occ(asionally)*. The definition of a *Survey* is as follows:³

- (24) a. $\lambda s. Survey'(P)(i)(s)$ is the set of surveys s of the property P at instant i , a survey being a total function from the extension of P at i to the instants k of some arbitrary interval K such that $\bigcup k_n = K$.
- b. $\lambda x. Sub(s, \hat{Q})(x)$ defines a sub-function of s from an individual x from the intersection of the domain of s with the extension of Q to some instant from a subset of the range of s .

The frequency adjective with the (again syncategorematic) determiner receives the following interpretation as a generalized determiner:

$$(25) \quad \lambda P. \lambda Q. \exists s [Survey'(P')(now)(s) \wedge AT(j, Occ'(\exists x [Sub(s, \hat{Q}'(x) = now)]))]$$

The interval j is randomly distributed and serves as a detached randomized timeline at the points of which frequency operators like *Occ(asionally)* can be evaluated. Assuming *sailor* for P and *strolls by* for Q , the analysis reads roughly: There is a total function s from the set of the current sailor individuals to the instants of some continuous interval, and at randomly distributed instants it is occasionally the case that there is an individual which then is both in the domain of s (= is a sailor) and in the set of individuals who *stroll by*.

Stump analyzes the generic reading (compare (4)) in a somewhat simpler way, although it is

³I give the formulae in a slightly modified symbolism which I consider more accessible than the original format used by Stump.

founded on the introduction of some quite strange entities into the ontology. Based on the fact that the generic reading is incompatible with stage level positions, Stump assumes abstract ontological kinds which realize in *daily*, *frequent*, etc. frequency, and which can have stage-located realizations of some other kind, for example the kind of cups of coffee. Summing things up quickly, the relevant definitions are given in (26), the analysis of generically read *a daily* (again a generalized determiner) in (27):⁴

$$(26) \quad \begin{aligned} \text{a. } & \text{Daily}^* \stackrel{\text{def}}{=} \lambda x. \exists i. \text{now} \subseteq i \wedge AT(i, \text{Daily}'(\exists y. R(y^s, x))) \\ \text{b. } & \text{In}' \stackrel{\text{def}}{=} \lambda P. \lambda x. \forall y^s. \forall i. AT(i, R(y^s, x) \rightarrow \exists z. P\{z\} \wedge R(y^s, z)) \end{aligned}$$

$$(27) \quad \lambda P. \lambda Q. Q\{\iota x^k [\forall x^o [R(x^o, x^k) \leftrightarrow [Daily^*(x^o) \wedge In'(\text{P}')(x^o)]]]\}$$

Saturating P with *cup of coffee*, and Q with *is good for your health*, the analysis reads roughly: the unique kind x^k which is such that all its object realizations x^o are daily and space-time collocated with realizations of cups of coffee is good for your health.

The major explanatory problems with Stump's overall lucid analysis are the two completely different semantic contributions for what really seems to be one adjective. Notice that, since none of the readings is more basic than the other, no account for the higher markedness of the adverbial reading or interlanguage parametrization is possible. Also, Stump does not cover the internal reading and its relation to the other readings. On the more theoretical/ontological side, the helper construct of *Survey* and the unusual abstract ontological kinds are a huge price to pay. An additional problem is the nonstandard assumption of space-time collocated stages of different individuals, an option specifically excluded in Carlson (1977). The context/concept-dependent nature of how relative frequencies are interpreted is also not explained in a natural way. In the next section, I will propose what I hope is a more natural solution in terms of event semantics.

4 Frequencies and the Ontology of Events

4.1 A Kind of Event

My starting point is the intuition that in the generic reading, the NP containing the frequency adjective refers to a **kind of events** which is attributed a characteristic realization frequency. In the adverbial reading, a **stage of a kind of objects involved in events** (again with a specified realization frequency) is denoted, and the main event parameter in this reading is identified with the main event parameter of the subcategorizing verb or inferred contextually.

If events are simply taken to be ontologically a sort of objects (as in all flavors of event semantics like Davidson (1967), Parsons (1990), Landman (2000), etc.), then they could be expected to allow the distinction between kinds, individuals, and stages like any other object. And indeed, event nominals behave just like other nominals w.r.t. this distinction.⁵ In the present case, I want to exploit this ontology for a natural definition of how frequencies are calculated: as realization probabilities of kinds of events. The probabilistic formulation allows an entirely extensional treatment, since constant probabilities of event realizations can be evaluated extensionally at any index. In addition, event clumping is avoided naturally for the relative frequency adjective.

⁴ R is the Carlsonian realization relation realizing from kinds to objects. The superscripts k , o , s indicate the (ontological) sort as *kind*, *object*, and *stage*. Refer to Carlson (1977) or Krifka et al. (1995).

⁵Within the confines of this paper, I cannot go into the most likely subtle details of what exactly distinguishes kinds of events from event individuals and stages.

4.2 Probabilistic Frequencies

This subsection defines the core semantic contribution of frequency adjectives, whereas the following sections deal with the specific implementations of logical form for the various readings. First, I define a probability function p which takes an additional measure interval. The measure interval i determines the interval at which probability is evaluated. For mergers of galaxies, a relative frequency should probably be checked every n Million years, but for changes of locations of ions, frequency might be checked every few nanoseconds. This move allows us to keep the lexical content of specific frequency adjectives (the numeric probability value) fixed, while allowing the actual physical frequency of the occurrences to vary arbitrarily by modifying the checking interval. p calculates a subinterval (not a simple numeric value) of $[0, 1]$, because we want to allow for fuzzy definitions of probabilities.

$$(28) \quad p(\phi)(i) \stackrel{def}{=} \text{the probability that } \phi \text{ within } i$$

What will ϕ be for the definition of frequency adjective? We want to measure the frequency with which some event kind and some object kind⁶ realize as individual stages, while the object plays some role in the event.⁷

$$(29) \quad p(\exists e_2. \exists x_2. \mathbf{R}^{kis}(e_1^k)(e_2^s) \wedge \mathbf{R}^{kis}(x_1^k)(x_2^s) \wedge \Theta(x_2)(e_2))(i) = [n, m]$$

where \mathbf{R}^{kis} is a Carlsonian realization relation from kinds to stages of individuals, and Θ is a variable ranging over thematic roles.

Now we can specify a $[n, m]$ value for any relative frequency adjective to give the right distribution of actual events happening, say $[.7, .95]$ for *frequently*. The checking interval i will have to be chosen according to what kind of object and event we are dealing with. We can simply assume that for every combination of object and event kinds, there is one such interval, calculated by a function \mathbf{i} :

$$(30) \quad \mathbf{i}(e^k)(x^k)(\Theta) \stackrel{def}{=} \text{the prototypical checking interval for event kind } e^k, \text{ with object kind } x^k \text{ as filler of role } \Theta$$

For absolute frequency adjective, we simply have to set i to the interval associated with the adjective (like *1d* for *daily*) and the interval to values near 1, such as $[.98, 1]$ Why not $[1, 1]$? Imagine this situation: Agent Cooper has eaten a piece of huckleberry pie every day for as long as we can think. However, on three occasions huckleberries were out, and he had cherry pie instead. We still want the sentence *Agent Cooper has eaten a daily piece of hucklyberry pie for as long as we can think.* to be true in such a world. What counts is the long term average. The probability of the event occurring during (for example) one day must be close to 1.

I have defined the core contribution of frequency adjectives. The actual logical forms, discussed in the following subsections, have to be adapted to the conditions under which the adjective appears.

4.3 Event and Agent Nominals

Before I propose a detailed analysis of all uses of frequency adjectives, I would like to introduce a semi-formal notation for variables which have to be inferred or contextually identified. The

⁶I henceforth use the term *object* for non-event object and *event* for event object.

⁷I assume a Neo-Davidsonian format for the sake of convenience, cf. Parsons (1990).

best case to illustrate the need for such a mechanism is the adverbial reading with non-event nouns. In *A daily cup of coffee is good for your health.*, my analysis will assume coercion of *cup of coffee* to some kind of event description. In fact, it seems to be not the cup of coffee itself which has a positive effect on one's health, but rather what one does with it. For in a world where drinking a cup of coffee every day is healthy but pouring one over one's head is not, this sentence is either true or false, depending on what kind of event is assumed. Accompanied by an illustration of Agent Cooper pouring a cup of coffee over his head, the sentence would have to be considered false. The main event parameter (like **pour** and **drink**) must be inferred from world knowledge or context.⁸ In formulae, I mark such context/world knowledge-bound variables by \uparrow . I do not consider it a weakness of the current approach that it has to rely on a larger number of such inferences since I fail to see how purely linguistic representations could satisfactorily explain for the possible interpretations of sentences such as the one just given.

Equipped with a notion of realization frequencies, we can now model frequency adjectives with event nominals in a straightforward fashion. In (31), logical forms for both an event nominal and *occasional* are given, **I** being used as an abbreviation for **i** with the appropriate parameters specified.

- (31) a. $walk \Rightarrow \lambda e_4^k. \mathbf{walk}(e_4)$
 b. $occasional_1 \Rightarrow \lambda E. \lambda e_1^k. E(e_1) \wedge p(e_1)(\uparrow x_1^k)(\Theta)(\mathbf{I}) = [.3, .6]$
 c. $daily \Rightarrow \lambda E. \lambda e_1^k. E(e_1) \wedge p(e_1)(\uparrow x_1^k)(\Theta)(\mathbf{1d}) = [.98, 1]$
 d. $[occasional_1 [walk]]: \lambda e_1^k. \mathbf{walk}(e_1) \wedge p(e_1)(\uparrow x_1^k)(\Theta)(\mathbf{I}) = [.3, .6]$

occasional walk receives the compositional meaning of the set of event kinds which are walkings and for which the probability of realizing within an appropriate interval is between .3 and .6.

I suggest analyzing the case of the agent noun as similar, but with a harmless bracketing paradox.⁹ I suggest this solution also for a broader class of examples such as the event modifying reading of *beautiful* as in *Olga is a beautiful dancer*. The idea is to apply the adjective before the formative *-er* to the effect that the adjective and the event noun react exactly as in (31). In (32), a simple computation is suggested.

- (32) a. $-er \Rightarrow \lambda E. \lambda x_2. \exists e_5^k. E(e_5) \wedge Agent(x_2, e_5)$
 b. $[[occasional_1 walk]er]: (\lambda E. \lambda x_2. \exists e_5^k. E(e_5) \wedge \mathbf{agent}(x_2, e_5))$
 $(\lambda e_1^k. \mathbf{walk}(e_1) \wedge p(e_1)(\uparrow x_1^k)(\uparrow \Theta)(\mathbf{I}) = [.3, .6])$
 $=_{\beta} \lambda x_2. \exists e_5^k. \mathbf{walk}(e_5) \wedge p(e_5)(\uparrow x_1^k)(\uparrow \Theta)(\mathbf{I}) = [.3, .6] \wedge \mathbf{agent}(x_2, e_5)$

occasional walker thus denotes the set of individuals for which there is a kind of walking events which realizes occasionally and of which they are the agent. Again, the determiner can be added compositionally. The linearization data for agent nominals mentioned in section 2.4 are now explained: After the agentive suffix has applied, additional modifiers modifying the agent can be added (*a tall occasional walker*), but additional event modifiers have to be added before *-er* (like *an occasional quick walker*).

⁸This is also true for the thematic variable. The sentence *Leo likes an occasional makeover*. we cannot know without context or world knowledge whether he likes to be the agent or the patient of that makeover.

⁹I am confident that a morpho-phonological component could be adapted to handle this paradox.

4.4 Coerced Event Readings

As for the more complex cases with object nouns modified by frequency adjectives, I assume a form of coercion without committing to any specific theory of coercion. Coercion is merely used as a cover term for rescue processes which change the representation of linguistic entities to make some expression meaningful or grammatic. In the case at hand, coercion forces the frequency adjective to contribute its own completely underspecified event description and to find a way of consuming the object-denoting nominal correctly. The two readings under discussion, however, behave differently when it comes to fixing some of the inferred event parameters. From the completely underspecified variant, the generic reading and the adverbial reading fix the event variable and the object variable by lambda abstraction and existential quantification in an opposite fashion. (33) gives a schematic impression which will soon become clear.

- (33) a. generic reading:
 $p(\uparrow e)(\uparrow x)(\uparrow \Theta)(\mathbf{I}) \longrightarrow \lambda e.\exists x.p(e)(x)(\uparrow \Theta)(\mathbf{I})$
 b. adverbial reading:
 $p(\uparrow e)(\uparrow x)(\uparrow \Theta)(\mathbf{I}) \longrightarrow \lambda x.\exists e.p(e)(x)(\uparrow \Theta)(\mathbf{I})$

On the meaning side, the generic reading for examples like *occasional cup of coffee* will be interpreted roughly like *an occasional drinking (or other action) of a cup of coffee*, where the NP ends up as an event description. The adverbial reading is harder to construct. Sentences containing adjectives in the adverbial reading like *An occasional sailor strolled by.* are interpreted like *An instance of the kind of sailors which occasionally strolls by strolled by.*, the NP being interpreted as an object property (but containing an event description).

To be precise, *occasional*₂ in the **generic reading** will be defined as follows:

- (34) a. *occasional*₂ \Rightarrow
 $\lambda P.\lambda e_1^k.\exists x_3^k.\uparrow E(e_1) \wedge P(x_3) \wedge p(e_1)(x_3)(\uparrow \Theta)(\mathbf{I}) = [.3, .6]$
 b. [*occasional [cup of coffee]*]:
 $\lambda e_1^k.\exists x_3^k.\uparrow E(e_1) \wedge \mathbf{ccup}(x_3) \wedge p(e_1)(x_3)(\uparrow \Theta)(\mathbf{I}) = [.3, .6]$

Compared to *occasional*₁, the complete event kind description has to be added to make it possible for the adjective to look for an object property. The existence of the event kind (the main parameter of which is not computed by the grammar) is hard-coded, and the event kind variable is abstracted over to give the expression the required type (event kind to bool). By that typing, it is excluded that the NP appear in non-kind-level positions. Notice that we need not explicitly bind the object kind to some theta role of the event kind, because all we are interested in is a statement about with which frequency an individual stage of that object kind plays some theta role in an individual stage of the event kind.

As a welcome result, the linearization data mentioned in 2.4 are readily explained. Once the adjective has applied, the NP is no longer an object description to the effect that object modifiers like *hot* can no longer be added.

The generic reading was the result of two forces: The adjective looks for an event property (although its head noun denotes an object property), and it needs to return an event kind property. For the **adverbial reading**, one of these forces is different: The adjective has to modify an event property and return an object stage property. It is feasible to assume the last condition as it is probably a lexical requirement for verbs like *stroll by* that their first role must not be filled by event descriptions. The interpretation can be summarized as follows: The NP denotes

the properties of a stage of a kind of objects¹⁰ the individual stages of which are involved with a specified probability in events. These events are realizations of a kind which is attributed (through inference) the same main event parameter as the event kind of the matrix verb, and the theta role which they play is the same as that assigned to the NP by the matrix predicate. So, if during the last four hours sailors strolled by who were of the kind of sailors who stroll by occasionally, then there must have been a temporal distribution of individual stages of events and individual stages of sailors which meets the conditions for *occasional*. In line with the schema in (33), the logical forms are as follows:

- (35) a. *occasional*₃ \Rightarrow
 $\lambda P.\lambda x_3^k.\exists e_1^k.\uparrow E(e_1) \wedge P(x_3) \wedge p(e_1)(x_3)(\uparrow \Theta)(\mathbf{I}) = [.3, .6]$
 b. [*occasional* [*cup of coffee*]]:
 $\lambda x_3^k.\exists e_1^k.\uparrow E(e_1) \wedge \mathbf{ccup}(x_3) \wedge p(e_1)(x_3)(\uparrow \Theta)(\mathbf{I}) = [.3, .6]$

In this case, the position and the determiner will fix the status of the whole NP as a kind stage, not as a kind. Notice that the identification of E and Θ with the respective values from the matrix predicate and the role it assigns to the NP are not hard-coded but merely inferences, hence the \uparrow . However, in the adverbial reading, they are always identified with the matrix predicate's parameters. The freedom of context or world knowledge-driven inference does not exist for the adverbial reading.

This concludes the discussion of the possible logical forms for frequency adjectives. The next section will sum up the achievements and discuss some remaining problems.

5 Achievements and Residues

The project of finding one unified semantic contribution for all frequency adjectives was successful. The account based on probabilities of event realizations renders the difference between relative and absolute frequency in a natural way, and it effectively avoids event clumping for relative frequencies. The two marked variants of *occasional* merely add coerced material and adapt the type of the adjective by binding and abstraction while leaving the semantic core untouched. The occurrence of frequency adjectives with event and agent nominals was thus shown to be the basic one, which explains the fact that apparently all or very many languages have that construction. The coerced reading which is more flexible and frequent in English (generic) is the only coerced one allowed (marginally) in German. The thus emerging dispreference for the adverbial reading can clearly be attributed to its high markedness and high redundancy in connection with the existence of a blocking construction (a sentence with an adverbial) the semantics of which is distinctly simpler. In favor of the coercion analysis, it should be mentioned that other sorts of adjectives will require a similar mechanism. Compare adjectives like *quick* or *quiet* in (36).

- (36) A quiet/quick donut restores Sheriff Truman's power.

One problematic point is the incompatibility of the generic reading and the adverbial reading with most quantifiers. Zimmermann (2003) suggests an analysis in terms of near-grammaticalization of the Det + A complex, which is not implausible considering the marked nature of the construction. Such a move would not harm my achievements to eliminate the need for syncategorematic determiners, since a construction-specific restricted set of admissible determiners (which behave fully compositionally otherwise) is still more economical than a set of syncat-

¹⁰Kind stages are assumed in sentences like *Dogs are barking*.

egorematic determiners. On the other hand, it might also be pragmatic factors that restrict the set of compatible determiners, considering that the determiners available are the definite and indefinite article – in many analyses not truly quantificational determiners. Under the current analysis, adding a quantificational determiner to the \bar{N} constituents (forming *two occasional sailors, all occasional sailors*, etc.) would amount to quantifying over kinds of events in the case of the generic reading, and to quantifying over kind stages of objects in the adverbial reading. Actually, the former option might emerge as marginally possible. Consider the examples in (37). Both the occasional cup and the yearly talk are kind level arguments. In (37-a), the only marginally available interpretation would be that Cooper likes to be involved in two sorts of coffee-related events which occur occasionally. Say, he likes drinking a cup occasionally and pouring one over his head occasionally. This is in line with my analysis, and even (37-b) could receive a very implausible but theoretically possible interpretation along such lines. (37-c) works similarly. The only possible interpretation is that Noam likes two different kinds of event which occur yearly. This becomes even clearer due to the choice of an absolute frequency adjective. If the sentence were supposed to mean that Noam likes just two (individual) talks every year, they could not be *yearly*.

- (37) a. ?Agent Cooper likes two occasional cups of coffee.
 b. ?Agent Cooper likes all occasional cups of coffee.
 c. ?Noam likes two yearly talks about good and evil.

As for the adverbial reading, imagine what (38) could mean. It seems impossible to rescue the sentence by assuming the sailors came in pairs, an interpretation also excluded by the present analysis. What my analysis would predict is a meaning where it was the case that two kind stages of sailors who (usually) stroll by occasionally actually strolled by. If that were indeed the case, we could infer that quite a lot of sailors would have strolled by (roughly twice as many as usual for situations where *occasional* is appropriately used), and the sentence would make pragmatically dispreferred use of linguistic items.

- (38) #Two occasional sailors strolled by.

I am confident that this is a promising line of argumentation.

A final problem I could not solve is the restriction or tendency for the adverbial reading to be available with relative infrequency adjective only. As we have seen in section 2.3, it is not clear whether the generalization from Larson (1998) really holds. A carefully designed experiment with a larger group of natives would have to precede any further theoretical elaborations.

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