

Distributional modification: The case of frequency adjectives

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1 Introduction

- Different strategies to compose propositions about quantities that participate in a given event or have a given property:
 - Quantificational determiners and adverbs (e.g. *most, always*)
 - Modification: quantities as properties of masses or sets (e.g. *two, some*)
 - Predication of a property to a kind entity (e.g. generic sentences)
 - Frequency adjectives as a variation on the modification strategy: Properties of descriptions of kinds that get instantiated by sets of tokens (with a particular distribution)
- **Frequency adjectives (FAs)** (Bolinger 1967; Stump 1981; Larson 1998; Zimmermann 2003; Schäfer 2007; Gehrke and McNally 2011)
 - e.g. *daily, monthly, etc.; (in)frequent, sporadic; occasional, rare, odd*
 - One way to express frequency distribution over eventualities expressed by verbs
- FAs have been attributed different readings; e.g. the ‘adverbial reading’: The possibility of an adverbial paraphrase of the FA ((1))
 - (1) a. An occasional sailor strolled by.
= Occasionally, a sailor strolled by. (Bolinger 1967)
 - b. The storm was punctuated by a sporadic crash of thunder.
= Sporadically, the storm was punctuated by a crash of thunder. (Stump 1981)
 - c. She wrote me frequent letters. = Frequently, she wrote me letters.
- General challenges:
 - How to account for this apparent wide scope of a DP-internal adjective?
 - How to generally account for different readings that have been identified for FAs (internal, generic, adverbial)?
- This paper: General picture of FAs as distributional modifiers
 - FAs fall into two distinct classes: Temporal(ly) vs. non-temporal(ly distributing) FAs.
 - Different readings of FAs can be accounted for by one uniform semantics for each class.
 - Paraphrases can come about in different fashion.
e.g. (1): Three distinct strategies for achieving frequency distribution over eventualities
 - * Non-temporal FA as a second order kind modifier ((1a))
 - * Temporal FA as an intersective event kind modifier ((1b))
 - * Temporal FA with a non-event noun, incorporation (conditions: atomic event-entity-mapping, stereotypicality, bare plural; cf. Gehrke and McNally to appear) ((1c))
 - The analysis of the FA as an ordinary modifier is superior to earlier analyses that treat the FA as a covert quantifier.

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2 Three putative readings

• The internal reading

- (2) a. A frequent sailor (= one who sails frequently) won the regatta.
b. A frequent recipient of awards (= one who frequently receives awards) took the Rotary Club prize again.

- Possible paraphrase of [FA N]: “N who/that V’s / is V’d FA-ly”
- Restricted to participant nouns (e.g. *recipient, sailor, employee*), including stage nouns (e.g. *batter, passenger, guest, customer*; cf. Gupta 1980; Carlson 1982)
- Odd with event nouns (e.g. *visit, swimming, discussion*) ((3a)): A token event occurs only once in time, and thus will not be manifest on multiple occasions.
- Odd with sortal nouns (e.g. *beer, car, chair*, i.e. nouns other than participant and event nouns) ((3b)): Their semantics does not entail participation in an eventuality.
- Possible with all kinds of determiners ((4))

- (3) a. a frequent visit \neq a particular visit that happens frequently
b. a frequent letter \neq a particular letter that V’s/is V’d frequently

- (4) A/Some/One/The/That/Each frequent sailor I know owns his boat.

NEW Possible with some FAs ((5)), but not with others ((6)).

- (5) a. a daily/weekly Internet user = one who uses the Internet daily/weekly
b. a frequent/infrequent/sporadic/periodic visitor = one who visits frequently/etc.
c. a(n) occasional reader of the newspaper = one who reads the newspaper occasionally
- (6) a. an odd user/visitor/reader \neq one who uses/visits/reads on odd occasions
b. a rare writer/winner/employee \neq one who writes/wins/is employed rarely

• The generic reading

- (7) a. A(n) monthly/frequent/occasional check-up is essential.
b. A(n) yearly/infrequent/rare visitor is not a problem.
c. A daily/sporadic cup of coffee is harmless.
d. The odd glitch is tolerable.
e. ...there is little evidence to show that the rare drink will impair the healthy growth of a baby. (<http://answers.yahoo.com/question/index?qid=20110501003637AAeLyDj>)

- Possible paraphrase (Stump 1981): *now and then, from time to time, every day* etc.; (8)

- (8) a. A check-up on a monthly/frequent/occasional basis is essential.
b. A visitor on a yearly/infrequent basis is not a problem.
c. A cup of coffee on a sporadic basis is harmless.
d. A glitch on odd occasions is tolerable.
e. A drink on rare occasions will (not) impair the healthy growth of a baby.

- The generic reading naturally arises when the DP containing the FA is an argument to a generic predicate (e.g. (7)) (Stump 1981; Schäfer 2007), and when the nominal is interpretable as generic independently of the presence of the FA:

- (9) a. A check-up is / Check-ups are essential.
b. A visitor is / Visitors are not a problem.
c. A cup of coffee is / Cups of coffee are harmless.

– With episodic predicates, the FA is unacceptable or not paraphrasable as in (9):

- (10) a. ??An occasional cup of coffee has left circular stains on the table. (Stump 1981)
b. The Premier Division-based Scotland side were only beaten, in fact, by a goal of almost tragic proportions, conceded when an infrequent error was characteristically punished by Riedle. (BNC)
≠ An error on an infrequent basis was characteristically punished by Riedle.

– Schäfer (2007): Restricted to (in)definites, semantically bleached possessives:

- (11) a. An/The/Your occasional beer is good for you.
b. ??Each occasional beer is good for you.
c. ??Two/??Many occasional beers are good for you.

NEW Some FAs require the indefinite ((12)), others the definite article ((13)); only *occasional* allows both ((11a)); correlates with (un)availability of the internal reading.

- (12) a. ??The/??Your daily shower is good for you.
b. ??The/??Your infrequent/frequent beer is good for you.
c. ??The/??Your sporadic/periodic inspection is necessary.

- (13) a. An odd glitch is/Odd glitches are tolerable.
≠ The occurrence of glitches on odd occasions is tolerable.
b. A rare drink/Rare drinks will not impair the healthy growth of a baby.
≠ A drink on rare occasions will not impair the healthy growth of a baby.

– With the first group of FAs (those in (12), but not those in (13)), the generic reading is systematically available only with event nouns.

– With other nouns: they have to be coercible into event descriptions (cf. Schäfer 2007):

- (14) a. A frequent cup of coffee helps keep John awake.
= Drinking a cup of coffee frequently helps keep John awake.
b. Occasional newspaper articles are part of John's job.
= (e.g.) Writing/Editing newspaper articles occasionally is part of John's job.

● **The adverbial reading** (first observed in Bolinger 1967)

- (15) The occasional sailor strolled by. = Occasionally, a sailor strolled by.

– Possibility of adverbial paraphrase, apparent wide scope of the FA

– This is not possible with FAs under the internal ((16a)) or generic reading ((16b)).

- (16) a. A frequent sailor won the regatta.
≠ Frequently, a sailor won the regatta.
b. A frequent checkup is essential.
≠ Frequently, a checkup is essential.

– Stump (1981); Zimmermann (2003); Schäfer (2007): Restricted to (in)definites, semantically bleached possessives:

- (17) a. We saw an/the/your occasional car on the road.
= Occasionally, we saw a car on the road.
b. ??We saw each occasional car on the road.
≠ Occasionally, we saw each car on the road.
c. ??We saw two/some/many occasional cars on the road.
≠ Occasionally, we saw two/some/many cars on the road.

NEW Same determiner restrictions wrt particular FAs as with the generic reading ((18)-(20))

- (18) a. **The**/?**An** odd sailor strolled by.
= On odd occasions, **a** sailor strolled by.
- b. He might point out **the**/?**an** odd bird or tell us the name of a plant, but these park excursions were not botanical treks. (COCA)
= On odd occasions, he might point out a bird...
- c. ...Brown himself did imbibe **the**/?**an** odd drink (he appears not to have been a temperance advocate)... (COCA)
= On odd occasions, Brown himself did imbibe a drink...
- (19) a. The pier is still used by **the**/?**a** rare passenger. (Google books)
= Rarely, the pier is still used by a passenger.
- b. she runs her family's Sea-View Motel and Restaurant on a patch of northern Florida coastline...that sees only **the**/?**a** rare tourist. (COCA)
= ...that rarely sees a tourist
- c. In Hinsonville, **the**/?**a** rare family had just one parent, and that condition was usually quickly altered by the second marriage of the widow or widower. (Google books)
= Rarely, a family had just one parent.
- (20) a. **The** occasional sailor strolled by.
= Occasionally, **a** sailor strolled by.
- b. **An** occasional sailor strolled by.
= Occasionally, **a** sailor strolled by.

NEW Same restriction to event nouns with the first group of FAs ((21), (22)); i.e. those FAs that allow the internal reading

- (21) a. An (in)frequent/sporadic/periodic sailor strolled by.
≠ (In)frequently/Sporadically/Periodically, a sailor strolled by.
- b. The (in)frequent/sporadic/periodic sailor strolled by.
≠ (In)frequently/Sporadically/Periodically, a sailor strolled by.
- c. Frequent sailors strolled by.
≠ Frequently, a sailor/sailors strolled by.
- (22) a. A daily/weekly/monthly sailor strolled by.
≠ Daily/Weekly/Monthly, a sailor strolled by.
- b. The daily/weekly/monthly sailor strolled by.
≠ Daily/Weekly/Monthly, a sailor strolled by.

- This second class of FAs allows an adverbial paraphrase with non-event nouns only under particular conditions (for details see Gehrke and McNally to appear).
 - Unique discernible events, uniformity across subevents, temporal continuity within events (Atomic Event-Entity Mapping)
 - Stereotypicality
 - Bare plurals

(23) She sent me frequent letters / ??a frequent letter / ??frequent posters.

→ Semantic incorporation, association of the noun with an event (building on Pustejovsky 1995; Larson 1998; Chung and Ladusaw 2003; Kennedy 2012)

3 Changing the perspective: Temporal vs. non-temporal distribution

Type of FA	Temporal	Nontemporal	Both
	<i>(in)frequent, periodic, sporadic daily, etc.</i>	<i>odd, rare</i>	<i>occasional</i>
Internal reading	✓	*	✓
Adverbial reading with non-event nouns	*	✓	✓
Determiner used with the generic and/or adverbial reading	✓ <i>a</i> ?? <i>the</i>	?? <i>a</i> ✓ <i>the</i>	✓ <i>a</i> ✓ <i>the</i>
Nontemporal distribution	*	✓	✓
Predicative use on relevant reading	✓	*	✓

Table 1: Empirical generalizations revised

- **Temporal**(ly distributing) **FAs** (e.g. *(in)frequent, sporadic, periodic; daily, monthly* etc.):

- Nouns modified by temporal FAs can appear in the plural ((24a))
- Restriction to indefinite articles with sg. nouns (adv., gen.) ((24b))
- Do not allow distribution over a non-temporal domain ((24c))
Non-temporal distribution: The individuals in question can be temporally co-located as long as they are properly distributed over some other contextually-identified domain (e.g. space) (cf. Stump 1981).
- Temporal FAs can be used predicatively ((24d)).

- (24) a. The house underwent monthly/frequent/periodic/sporadic cleanings.
 b. The house underwent a/??the monthly/frequent/periodic/sporadic cleaning.
 c. ??A/??The monthly/frequent/periodic/sporadic sailor is 6 feet tall.
 d. The reviews were ?monthly/frequent/periodic/sporadic.

- **Non-temporal**(ly distributing) **FAs** (e.g. *odd, rare*):

- Nouns modified by non-temporal FAs cannot appear in the plural ((25a)).
- Restriction to definite articles with sg. nouns (adv., gen.) ((25b))
- Allow distribution over a non-temporal domain ((25c))
- Non-temporal FAs cannot be used predicatively ((25d)).

- (25) a. ??The house underwent odd cleanings. (on relevant reading)
 b. The house underwent ??an/the odd cleaning.
 c. ??An/The odd sailor is 6 feet tall.
 d. ??The sailor was odd. (on relevant reading)

- **occasional is ambiguous**

- Further illustration of non-temporal distribution:

- (26) a. a glimpse of commerce – the **occasional/odd/rare** office, barbershop, or Vietnamese strip mall...
 b. ??a glimpse of commerce – the **weekly/frequent/infrequent/periodic/sporadic** office, barbershop, or Vietnamese strip mall...

- (27) After a long trek, you and your band of friends arrive at a grey-brown wasteland. a plain filled with nothing but **the occasional hill**, a large plateau, and a ruined castle, it is a horrible place.
(<http://musescore.com/user/100240/scores/114572>)
- (28) a. It's in a room crowded with gauges and microscopes, along with **the odd bicycle and Congo drum**, on a leafy campus surrounded by Washington, D.C.'s Rock Creek Park (COCA)
b. In the middle of all this life is a featureless landscape: the occasional two-or three-story apartment building, put up in the twenties, when it was thought that people in this city would wish to live in apartments; a glimpse of commerce – **the odd office, barbershop, or Vietnamese strip mall**; some abandoned developments. (COCA)
- (29) a. In 1959 and 1960 it was a different world than it is now. There was **the rare female engineer**, but we weren't really guided or encouraged to go into other careers.
(<http://quest.arc.nasa.gov/space/frontiers/ohara.html>)
b. [He'll look back to] those caddieing days, his only burden someone else's 30-pound bag over his right shoulder, arriving hot and hungry at a halfway house. "There were some guys who would let you get a soda," Dunne says. "There were some guys who let you get a soda and a hot dog. And there was **the rare guy who would let you get a soda and a hamburger**. And you knew who those guys were."
(<http://www.golfdigest.com/golf-tours-news/2011-09/golf-fields-rosaforte-911?currentPage=5>)

4 The proposal

- Background assumptions:

- Reference to token (ordinary) entities and events, as well as kinds of entities and events
- **Nominal kinds** (Carlson 1977), implemented via a “layered” DP (Zamparelli 1995) ((30)): Nouns denote properties of kinds that are converted into properties of token entities via Num(ber) (see e.g. Farkas and Swart 2003; McNally and Boleda 2004; Déprez 2005; Espinal 2010; Müller-Reichau 2011, and references cited there for related proposals)
- **Verbal kinds** work analogously (e.g. Landman and Morzycki 2003; Ginzburg 2005; Sailer 2010; Gehrke 2012, to appear; Arsenijević, Boleda, Gehrke, and McNally 2014)

- (30) a. $\llbracket \llbracket_{NP} \llbracket_{N} \text{car} \rrbracket \rrbracket \rrbracket : \lambda x_k [\text{car}(x_k)]$
b. $\llbracket \llbracket_{NumP} \llbracket_{NP} \text{car} \rrbracket \rrbracket \rrbracket : \lambda y \exists x_k [\text{car}(x_k) \wedge \mathbf{R}(y, x_k)]$

- Kinds can be realized by sets of tokens (Gehrke and McNally 2011).
- FAs impose conditions on the distribution of these sets of tokens at a given index.

4.1 Temporal FAs

- Temporal FAs denote simple properties of event kinds or tokens:

- (31) $\llbracket \text{FA}_{temp} \rrbracket : \lambda e_\alpha [\mathbf{FA}_{temp}(e_\alpha)]$

- Satisfaction conditions for \mathbf{FA}_{temp} :

- A **distribution** is a relation between a (non-singleton) set of events and a well-defined stretch of time (or, as will be the case with nontemporal FAs, possibly space).
- FA applies to single event kinds ((32a)): A set of token event realizations can be retrieved, whose distribution can then be characterized.
- FA applies to token pluralities of eventualities ((32b)): The atoms of that plurality can be retrieved and be attributed a particular distribution.

- (32) a. $\forall e_k, i [\mathbf{FA}_{temp}(e_k) \text{ at } i \leftrightarrow \text{distribution}(\{e : \mathbf{R}(e, e_k) \text{ at } i\}) = \text{dist}]$
b. $\forall e, i [\mathbf{FA}_{temp}(e) \text{ at } i \leftrightarrow \text{distribution}(\{e' : \text{atomic-part-of}(e' < e) \text{ at } i\}) = \text{dist}]$

- The adjective combines with the noun via a predicate conjunction rule (see e.g. Larson 1998):

$$(33) \quad \begin{array}{l} \text{a. } \llbracket \text{frequent} \rrbracket: \lambda e_k [\mathbf{frequent}(e_k)] \\ \text{b. } \llbracket \text{frequent downdraft} \rrbracket: \lambda e_k [\mathbf{downdraft}(e_k) \wedge \mathbf{frequent}(e_k)] \\ \quad = \lambda e_k [\mathbf{downdraft}(e_k) \wedge \mathbf{distribution}(\{e : \mathbf{R}(e, e_k) \text{ at } i\}) = \textit{high}] \end{array}$$

- The NP *frequent downdraft* denotes a property of the downdraft event kind, whose instantiations have a high distribution over the given index *i*.
 - Intersective condition on the kind: The FA creates a subkind, characterized by the distribution of the instances of the superkind.
 - This subkind can be contrasted with other subkinds characterized by other distributions.
- Characterization of kinds of eventualities according to their distribution in time (e.g. classification of meetings as daily, weekly, monthly, annual, etc.)

- The combination of such a kind description with Number results in a description of token individuals of a kind whose distribution is determined by the FA; e.g. (34).

$$(34) \quad \llbracket \llbracket \llbracket \text{NumP} [\text{NP daily broadcast}] \rrbracket \rrbracket: \\ \lambda e \exists e_k [\mathbf{broadcast}(e_k) \wedge \mathbf{daily}(e_k) \wedge \mathbf{R}(e, e_k)]$$

- The plural case ((35)):

- The FA modifies a nominal that has already been converted into a description of a plurality of tokens (i.e. at the level of NumP).
- The whole phrase denotes the set of token pluralities of downdrafts whose atoms form a set with a high distribution at some temporal index.

$$(35) \quad \llbracket \llbracket \llbracket \text{NumP frequent} [\text{NumP downdrafts}] \rrbracket \rrbracket: \\ \lambda e \exists e_k [\mathbf{downdrafts}(e_k) \wedge \mathbf{R}(e, e_k) \wedge \mathbf{frequent}(e)]$$

4.1.1 Some basic facts accounted for

- The intersective analysis correctly predicts:

- Temporal FAs occupy post-nominal position in Romance languages (e.g. Spanish), a position reserved for intersectively interpreted modifiers ((36)).

$$(36) \quad \begin{array}{lll} \text{un problema frecuente} & \text{'a frequent problem'} & \text{(Spanish)} \\ \text{a problem frecuente} & & \end{array}$$

- Temporal FAs can coordinate with other intersective modifiers of the same general sort (e.g. event kind modifiers) ((37a,c)).
- There is a certain freedom in the ordering of these modifiers ((37b,d)).²

$$(37) \quad \begin{array}{l} \text{a. } \dots \text{an occasional and brief downdraft will occur within the chimney...} \\ \quad (\text{http://www.patentstorm.us/patents/6298844/description.html}) \\ \text{b. } \text{a brief, occasional downdraft} = \text{an occasional, brief downdraft} \\ \text{c. } \text{a frequent and widely-recognized problem} \\ \text{d. } \text{a frequent, widely-recognized problem} = \text{a widely-recognized, frequent problem} \end{array}$$

²This combinatorial freedom is somewhat restricted. The greater the semantic difference between the information provided by the two modifiers, the more difficult it is to combine them absolutely freely (e.g. *?a yearly and external review*; *a yearly external review* = *an external yearly review*). However, we suspect that pragmatic factors intervene in accounting for these restrictions, as similar effects are found on adjective coordination and ordering more generally (e.g. *a tall, fascinating child* vs. *?a fascinating, tall child*) (see e.g. Bouchard 2005; Svenonius 2008, and references cited there for discussion of adjective ordering).

4.1.2 Capturing the different paraphrases

- We use *frequent* for illustration:

$$(38) \quad \begin{array}{l} \text{a. } \llbracket \text{frequent} \rrbracket: \lambda e_\alpha [\mathbf{frequent}(e_\alpha)] \\ \text{b. } \forall e_k, i [\mathbf{frequent}(e_k) \text{ at } i \leftrightarrow \mathbf{distribution}(\{e : \mathbf{R}(e, e_k) \text{ at } i\}) = \text{high}] \end{array}$$

- **The internal reading:** The FA modifies a deverbal participant noun or a stage noun.

$$(39) \quad \text{John is a frequent sailor.}$$

→ These nouns have an additional event [kind] argument in their semantic representation (see e.g. Winter and Zwarts 2011):

$$(40) \quad \begin{array}{l} \text{a. } \llbracket \llbracket \llbracket NP \llbracket N \text{ sailor} \rrbracket \rrbracket \rrbracket: \lambda x_k \lambda e_k [\mathbf{sail}(e_k) \wedge \mathbf{Agent}(x_k, e_k)] \\ \text{b. } \llbracket \llbracket \llbracket NumP \llbracket NP \text{ sailor} \rrbracket \rrbracket \rrbracket: \lambda y \exists x_k, e_k [\mathbf{sail}(e_k) \wedge \mathbf{Agent}(x_k, e_k) \wedge \mathbf{R}(y, x_k)] \end{array}$$

- Since the FA is sortally restricted to apply to events, the only option is for it to apply to the event argument in the noun’s representation:³

$$(41) \quad \llbracket \llbracket NP \text{ frequent sailor} \rrbracket \rrbracket: \lambda x_k \lambda e_k [\mathbf{sail}(e_k) \wedge \mathbf{Agent}(x_k, e_k) \wedge \mathbf{frequent}(e_k)]$$

- When Number is added, the result is a description of those token individuals of the sailor kind who participate in that kind of event that can be described as frequent sailing:

$$(42) \quad \llbracket \llbracket NumP \text{ frequent sailor} \rrbracket \rrbracket: \lambda y \exists x_k, e_k [\mathbf{sail}(e_k) \wedge \mathbf{Agent}(x_k, e_k) \wedge \mathbf{frequent}(e_k) \wedge \mathbf{R}(y, x_k)]$$

- Predictions of this analysis, which are borne out:

- Expressions with representations like that in (42) can combine with any determiner; cf. (4).
- Any token-level modification has to appear further away from the head noun than the (kind-level modifying) FA (see McNally and Boleda 2004, for related examples); cf. (43).

$$(43) \quad \begin{array}{l} \text{a. } \text{Martin is a skilled frequent sailor.} \\ \text{b. } ??\text{Martin is a frequent skilled sailor.} \end{array}$$

- **The generic reading:** The FA-modified noun appears with a generic predicate.

- Two kinds of cases: the modified noun describes an event ((44)), or it does not ((45)), at least not at first sight.
- In both cases, as a rule, the generic reading requires the indefinite article or bare plural and is incompatible with the definite article.

$$(44) \quad \begin{array}{l} \text{a. } \text{A periodic inspection is important.} \\ \text{b. } \text{Periodic inspections are important.} \\ \text{c. } ??\text{The periodic inspection is important.} \end{array}$$

$$(45) \quad \begin{array}{l} \text{a. } \text{A frequent glass of wine is healthy.} \\ \text{b. } \text{Frequent glasses of wine are healthy.} \\ \text{c. } ??\text{The frequent glass of wine is healthy.} \end{array}$$

³The exact mechanism via which the adjective accesses this argument is not crucial; see e.g. Pustejovsky (1995); Larson (1998); McNally and Boleda (2004) for different implementations.

– Without the FA, the definite also lacks a generic reading (in both cases; (46)).

- (46) a. The inspection is important.
b. The glass of wine is healthy.

→ As the FAs simply contribute an additional intersective condition on the nominal description, their presence or absence does not have an impact on the eventual availability of a (non)generic interpretation of the nominal.⁴

• The semantics of (44a) is given in (47).

- General analysis of generic sentences involving indefinite singular and bare plural DPs; we exemplify just the indefinite singular.
- The source of genericity in indefinite generic sentences is external to the subject DP; the indefinite is nonquantificational (e.g. Farkas and Sugioka 1983; Cohen 2001; Greenberg 2002; Krifka 2013).

(47) $(\mathbf{Gen} e_k : \mathbf{inspection}(e_k) \wedge \mathbf{periodic}(e_k))[\mathbf{important}(e_k)]$

• The semantics of cases involving non-event nouns, such as (45):

- Coercion of the denotation of the noun to an event description (e.g. (48a) is paraphrasable as in (48b))

- (48) a. A daily beer is healthy.
b. V-ing a beer on a daily basis is healthy.

– We use a function **E** to induce the appropriate coercion (cf. Schäfer 2007):⁵

(49) $(\mathbf{Gen} e_k : \mathbf{E}(\mathbf{beer})(e_k) \wedge \mathbf{daily}(e_k))[\mathbf{healthy}(e_k)]$

• **The adverbial reading:** Paraphrasability of the FA in terms of a sentence-level adverb

- With FA_{tempS} , this paraphrasability is only systematically possible with event nominals:

(50) The department has undergone a periodic review (over the last 10 years).
= Periodically, the department has undergone a review.

- The DP is an instance of an indefinite kind nominal, such as the ones in (51) (see e.g. Dayal 2004; Müller-Reichau 2011).

- (51) a. A giant tortoise has recently become extinct.
b. Fred invented a pumpkin crusher.

• The semantics of (50):⁶

(52) a. $\llbracket \text{periodic review} \rrbracket : \lambda e_k [\mathbf{review}(e_k) \wedge \mathbf{periodic}(e_k)]$
b. $\llbracket \text{a periodic review} \rrbracket : f_i (\lambda e_k [\mathbf{review}(e_k) \wedge \mathbf{periodic}(e_k)])$

⁴We assume that the same explanation extends to the failure of the definite article to appear with temporal FAs on the so-called adverbial reading (see below), which also involves interpreting the FA-modified nominal as a kind description.

⁵This sort of coercion is well known (consider cases such as the interpretation of *the book* in *enjoy the book*), and our analysis is compatible with any independently-motivated account of coercion (see e.g. Asher 2011, for a recent proposal).

⁶For the sake of illustration we treat the resulting DP as denoting the entity returned by a choice function f_i on the set denoted by *periodic review* (Reinhart 1997; Kratzer 1998). Whether the choice function variable is treated as existentially quantified or as a contextually-valued free variable is not crucial here; we treat it as a free variable.

- Gehrke and McNally (2011):
 - Due to the distribution condition on the set of tokens that realize this kind, such set could not participate in one token event of the sort described by the verb.
 - However, nothing would prohibit it from participating in the *kind* of event described by the verb, if the latter could be instantiated by multiple tokens.
- Sentences with the adverbial reading correspond to propositions about event kinds:

$$(53) \quad \llbracket \text{The department has undergone a periodic review} \rrbracket: \\ \exists e_k [\mathbf{undergo}(e_k, \mathbf{d}, f_i(\lambda e'_k [\mathbf{review}(e'_k) \wedge \mathbf{periodic}(e_k)]))]]$$

- Satisfaction conditions for sentences that are used to make assertions about event kinds:
 - In order for an event kind to exist at some index i , at least one realization of the event kind should exist at i ; cf. (54).⁷

$$(54) \quad \forall e_k, x_\alpha, P, i [P(e_k, x) \text{ at } i \leftrightarrow \exists e, x_\alpha [\mathbf{R}(e, e_k) \wedge P(e, x_\alpha) \text{ at } i]]$$

- Each element of the set that realizes the participant should participate in a token event of the relevant event kind.
- In such cases, it will follow automatically that the corresponding token events will satisfy the same distribution as the token participants.
- Thus, for (53) to be true, there will have to be a set of token review-undergoing events with a distribution that can be described as “periodic”.

⇒ **With a single denotation for the temporal FAs, we have accounted for the three classic readings associated with these adjectives.**

4.2 Non-temporal FAs

- The semantics for nontemporal FAs is identical to the one for temporal FAs, except for:
 - Nontemporal FAs are not sortally restricted to describing event distributions.
 - They lack the predicative use.
 - Their semantics is exclusively that of a modifier (of event kinds):

$$(55) \quad \llbracket \mathbf{FA}_{nontemp} \rrbracket: \lambda P \lambda x_k [(\mathbf{FA}(P))(x_k)]$$

- The satisfaction conditions for nontemporal FAs are the same as those for temporal FAs (compare (56b) with (32a)).

$$(56) \quad \forall P, x_k, i [(\mathbf{FA}_{nontemp}(P))(x_k) \text{ at } i \leftrightarrow \\ [P(x_k) \wedge \mathbf{distribution}(\{y : \mathbf{R}(y, x_k) \text{ at } i\}) = \mathit{dist}]]$$

- An example:

$$(57) \quad \begin{array}{l} \text{a. } \llbracket \mathbf{odd} \rrbracket: \lambda P \lambda x_k [(\mathbf{odd}(P))(x_k)] \\ \text{b. } \llbracket \mathbf{odd\ car} \rrbracket: \lambda x_k [(\mathbf{odd}(\mathbf{car}))(x_k)] \\ \text{c. } \forall x_k, i [(\mathbf{odd}(\mathbf{car}))(x_k) \text{ at } i \leftrightarrow [\mathbf{car}(x_k) \wedge \mathbf{distribution}(\{y : \mathbf{R}(y, x_k) \text{ at } i\}) = \mathit{low}]] \end{array}$$

⁷This is the intuition behind the semantics of existential sentences in McNally (1992), which built on observations in Strawson (1959); a deeply similar idea underlies Carlson’s (1977) analysis of nongeneric sentences involving kind terms.

4.2.1 Some basic facts accounted for

- The proposal that nontemporal FAs do not denote simple (first order) properties of (kinds of) individuals is crucial to explaining various contrasts between them and temporal FAs.
 - Nontemporal FAs do not coordinate with intersective modifiers:
- (58) a. ??The museum had the odd/rare and brief visit from school groups.
 b. ??The occasional and fast car drove by.
- Changing the order of these FAs with respect to other modifiers clearly produces a corresponding change in interpretation, something typical of predicate modifiers:
- (59) Only the odd/rare/occasional 2-door car will have enough leg room in the back seat.
 ≠ Only the 2-door odd/rare/occasional car will have enough leg room in the back seat.
- Restrictions to singular definites: Restriction to the unique maximal kind
 - The nominal that the FA combines with denotes the set of kinds described by that nominal.
 - This set includes the general kind and any recognizable subkinds.
 - Whenever we convert the kind description to a description of tokens, there is always only one unique kind that the tokens are entailed to be realizing: the maximally general kind.
 - When the FA combines with a kind description, it returns the description of the unique kind upon whose realizations distributional conditions are being imposed.
 - Nominals containing these FAs reject any determiner that does not entail uniqueness (restriction to *the* and the bleached possessive).

4.2.2 Capturing the different paraphrases

- An example:

(60) [[the odd car]]: $\iota x_k [(\mathbf{odd}(\mathbf{car}))(x_k)]$

→ Nontemporal FAs do not allow the **internal reading**:

- The internal reading arises when the FA intersectively modifies an internal event argument within the representation of a nominal.
 - There is no way for nontemporal FAs to achieve this kind of modification, as they crucially apply to descriptions of (kinds of) individuals, rather than to (kinds of) individuals themselves.
- **The generic and adverbial readings** can be straightforwardly accounted for in fundamentally the same way as they were accounted for with temporal FAs; differences:
 - The kind term contributed by the nominal containing a nontemporal FA is marked with the definite article and thus has a unique denotation.
 - The kind variable in the denotation of the nominal is not available for binding e.g. by a generic adverbial operator.

(61) a. The odd glitch is tolerable.
 b. $\mathbf{tolerable}(\iota x_k [(\mathbf{odd}(\mathbf{glitch}))(x_k)])]$

(62) a. The occasional beer is healthy. = V-ing a beer on an occasional basis is healthy.
 b. $\mathbf{healthy}(\iota e_k [\mathbf{E}(\mathbf{occasional}(\mathbf{beer}))(e_k)])]$

- (63) a. The occasional sailor strolled by.
 b. $\exists e_k [\text{strolled_by}(e_k, \iota x_k [(\text{occasional}(\text{sailor}))(x_k))]]$

⇒ With one semantics we account for all “readings” of the adjective.

⇒ The different paraphrases are simply a byproduct of other elements in the sentences in which they occur.

5 Advantages over previous analyses

- Two basic sorts of previous analyses:
 - FAs under the adverbial reading are complex determiners, and thus different from FAs under the internal or generic readings (which are not directly accounted for; see Stump 1981; Larson 1998; Zimmermann 2003).
 - The unified account for all readings of all FAs, treating the FA as a modifier (Schäfer 2007; Gehrke and McNally 2011)
- The main points of this section:
 - FAs are not determiners (see also Gehrke and McNally 2011, for more arguments).
 - The recognition of the distinction between temporal and nontemporal distribution, missing in all previous proposals, solves a number of puzzles that have not been accounted for.

5.1 The determiner analysis of the adverbial reading

- We use the analysis in Zimmermann (2003) to illustrate:
 - FAs under the adverbial reading syntactically incorporate into the determiner, as in (64) (Zimmermann 2003, 271, minor details modified).

(64) $[\text{IP}[\text{QP}[\text{Q the/an+occasional}_1][\text{NP } t_1 \text{ sailor}]]_2[\text{VP } t_2 \text{ strolled by}]]$

- The result is a complex pluractional quantifier INFREQ over event-individual pairs that are found within a larger, contextually identified event ((65a)).
- The semantics for a sentence containing an INFREQ is presented informally in (65b) (adapted from Zimmermann 2003, 272, non-crucial details simplified).

- (65) a. $[[\text{an/the occasional N VP}]]:$
 $(\text{INFREQ}\langle e, x \rangle : \text{part-of}(e, e^*) \wedge N(x))[\text{VP}(e, x)]$
 b. There are some pairs $\langle e, x \rangle$, with e part of a contextually given event e^* , and x having property **N**, such that e is an event of x **VP**-ing, and any two events of x **VP**-ing occur at separate points in time.

- Two main sorts of arguments in favor of the determiner analysis:
 - The FA appears to scope over the entire sentence.
 - The FA does not behave like a “typical adjective” in some respects (coordination with and relative order with respect to other adjectives, etc.).

⇒ The latter argument is not convincing but result from the fact that they are not intersective (see Gehrke and McNally 2011, for details).

⇒ **Unexpected scope facts**

- Normally, nothing prevents a quantifier in object position from taking scope over a sentence in which there is no other quantificational operator. However, consider (66).

(66) Idling beside the propped-open kitchen window he registers the occasional car swishing past, three stories below. (COCA)

- There is no reason in principle why an INFREQ operator contributed by the FA (in conjunction with the determiner) should not be able to effectively scope over the entire sentence.
- Compare, for example (67a), where the determiner *many* is substituted for *the occasional*.
- The crucial part of the sentence can be paraphrased as in either (67b) or (67c).

(67) a. Idling beside the propped-open kitchen window he registers many cars swishing past, three stories below.
 b. There are many cars swishing past that he registers.
 c. There are many cars such that he registers them swishing past.

- The determiner analysis predicts that (66) should be paraphrased as in (68a) or (68b), depending on the syntactic analysis one adopts:

(68) a. There are some pairs $\langle e, x \rangle$, with e part of a contextually given event e^* , and x a car swishing past, such that e is an event of him registering x , and any two events of him registering x occur at separate points in time.
 b. There are some pairs $\langle e, x \rangle$, with e part of a contextually given event e^* , and x a car, such that e is an event of him registering x swishing past, and any two events of him registering x swishing past occur at separate points in time.

- (66) entails that there are few cars swishing past, but neither of the informal representations in (68) carries this entailment.
- Rather, these representations only entail that there are few events of the subject referent registering the car (swishing past), and this could be the case if there are many cars (swishing past) and he simply fails to notice most of them.
- The effect of the FA appears to be only over events of swishing past, rather than to events of registering.
- We see no independently-motivated mechanism that could produce this effect, assuming the determiner analysis.

These sorts of examples are not problematic for the analysis proposed here:

- They receive the same analysis as examples such as (63) (y_i represents the pronoun *he*; we assume a small clause analysis for illustration):

(69) $\exists e, e_k [\mathbf{register}(e, y_i, \mathbf{swishing_past}(e_k, \iota x_k [(\mathbf{occasional}(\mathbf{car}))(x_k)]))]$

- The satisfaction conditions for this sentence will guarantee that the distribution of token cars is low; this, in turn, will guarantee that there are few token events of such cars swishing past.
- The sentence describes a token event of y_i registering that kind of event that is one of the occasional car swishing past.

⇒ Unexpected determiner facts

- Assumption in the literature: the adverbial reading is only available with the (in)definite articles and semantically bleached possessives.
- Zimmermann accounts for this restriction on the hypothesis that these determiners are semantically empty.

Problem: Why must the FA be accompanied by an overt article in the first place (cf. (70))?

(70) *Occasional sailor strolled by.

Failure to recognize that there are two patterns to the distribution of determiners with FAs, one for temporal and the other for nontemporal FAs.

- The claim that semantic emptiness accounts for the determiner restriction is thus incorrect, and as a result the difficulty of explaining how the FA would contribute quantificational or referential force when there must also be a determiner doing so reemerges.

Since the determiner analysis does not relate the generic and adverbial paraphrases, it has nothing to say about why any given FA shows a similar pattern of determiner restrictions on *both* the adverbial and generic readings.

5.2 Analyses that do not distinguish subclasses of FAs

- All previous analyses of FAs failed to observe the distinction between temporal and nontemporal FAs and thus left open questions (cf. Gehrke and McNally 2011), which we can now answer:
 - Why do different FAs manifest different determiner restrictions?
 - Why do different FAs vary in the paraphrases they admit depending on the sort of noun being modified?
- Our proposal accounts for another, previously unrecognized contrast between the two classes: whether or not they allow a predicative use

6 Conclusion

- FAs as a new strategy to provide information about quantities: Distributional modification of kind descriptions
- FAs fall into two different subclasses: temporal(ly) vs. nontemporal(ly distributing) FAs
 - Differences between temporal and nontemporal FAs are attributable to the fact that the former are intersective modifiers sortally restricted to events, while the latter are not.
 - Kinds can be realized by sets of tokens, rather than individual tokens.
 - Some clauses are descriptions of event kinds, rather than descriptions of event tokens.
- This new division solves a number of puzzles that previous analyses failed to explain.
- The account treats FAs as true adjectives, rather than stipulating that they are complex determiners (quantifiers).

- The analysis is not fully unified for FAs (as one class), but a unified analysis of each individual FA is provided (exception: *occasional*, which is ambiguous).
 - While an analysis that is not fully unified might be argued to lose something in elegance or simplicity, this loss is outweighed by considerable gains in empirical coverage.
 - The loss of uniformity is clearly anchored in lexical variation, where we might expect idiosyncrasy to lie.
- There is generally more than one way in natural language to convey truth-conditionally equivalent information.
- Question: Does this lead to a reanalysis of quantificational adverbs such as *frequently* or *occasionally* as predicates of event kinds?

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