

A Compositional Analysis of Anti-Quantifiers as Quantifiers

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1. Introduction

This paper presents a surface-compositional analysis of the construction in (1ab).

- (1) a. The boys bought three sausages *each*.
b. Die Jungen kauften *jeweils* drei Würstchen. [German]
the boys bought each three sausages

The sentences in (1ab) contain a distributive element that forms a constituent with an indefinite (mostly numeral) expression (the ‘DistShare’). The distributive element distributes the denotation of the DistShare over the denotation of a clausemate plural expression (the ‘DistKey’).

In the literature, this construction is known under various names, including ‘shifted *each*’ (Postal 1975), ‘anti-quantifier’ (Choe 1987), and ‘binominal *each*’ (Safir & Stowell 1988). It has the following characteristic properties (cf. Choe 1987, Safir & Stowell 1988, Junker 1995). As mentioned, the DistShare must be an indefinite (or better: non-specific) expression.

- (2) *The boys love the woman / every woman / that woman each.

Second, the DistKey must be a plural expression.

- (3) *Peter / *the Prime Minister / *that man loves two women each.

Third, distributive element and DistKey must be clausemates.

- (4) *The store clerks said that Peter had bought one balloon each.
intended reading: ‘Each of the store clerks said that there was one (different) balloon that Peter had bought.’

Finally, observe that the construction is found in a range of related and unrelated languages.

- (5) a. De jongens hebben *elk* twee boeken gelezen. [Dutch]
the boys have each two books read
b. Guttene har kjøpt to pølser *hver*. [Norwegian]
boys-the have bought two sausages each
c. Strákarnir keyptu tvær pylsur *hvor/ hver*. [Icelandic]
boys-the bought two sausages each_{dual} each_{pl}

- d. Les professeurs ont lu deux livres *chacun*. [French]
 the professors have read two books each
 (Tellier & Valois 1993:574, ex.1a)
- e. I ragazzi comprarono un libro *ciascuno* [Italian]
 the boys bought a book each
 (Burzio 1986:198, ex.50b)
- f. Mal'chiki kupili *po* dve sosiski *kazhdyj*. [Russian]
 boys_{NOM} bought PREP two sausages each
 'The boys bought two sausages each.'
- g. John i Mary kupicha *po* edna tetradka. [Bulgarian]
 John and Mary bought PREP one notebook
 'John and Mary bought a notebook each.' (Petrova 2000, ex.7)
- h. Otoko=tati-ga *sorezore* huta=ri-no zyosei-o aisi teiru] koto.[Jap.]
 men=pl - NOM each two=cl-GENwomen- ACC love-asp fact
 'The men love two women each.' (Sakaguchi 1998:115,ex.1)
- i. ai-tul-i phwungsen-hana-ssik-ul sa-ess-ta. [Korean]
 child-pl-NOM balloon one each ACC bought
 'The children bought a balloon each.' (Choe 1987:49,ex.13)

The widespread occurrence of the construction suggests that we deal with a general, possibly universal phenomenon here.

2. Two Problems

The construction in (1ab) raises two questions for the syntax-semantics interface. I will refer to these as the 'Compositionality Problem' and the 'Cross-Linguistic Problem' respectively.

2.1. *The Compositionality Problem*

The overt position of English *each* and German *jeweils* in (1) is problematic for surface-compositionality. This is illustrated schematically in (6ab).

- (6) a. The boys bought [_{DP} [three sausages] *each*].
 b. $\forall x$ [boy'(x) \rightarrow $\exists y$ [3sausages'(y) & x bought y]]

Unlike other adnominal quantifiers, the distributive quantifiers in (1) appear not to form a syntactic unit with their semantic restriction (*the boys*). Instead, they form a constituent with the DistShare *three sausages* (cf. Choe 1987, Stowell & Safir 1988, Junker 1995, Zimmermann, in prep.).¹ In other words, the distributive quantifiers seems to be in the wrong syntactic position from a semantic point of view. For this reason, Choe (1987) calls them 'Anti-Quantifiers' (= 'AQs').

Existing analyses of AQs (e.g. Link 1986/98, Choe 1987, Junker 1995, Moltmann 1991, Moltmann 1997, Sauerland 2001) try to reconcile the clash

between overt syntax and semantic interpretation in various ways, but all of them have in common that they are not surface-compositional.

2.2. *The Cross-Linguistic Problem*

The second question is how to account for an observable cross-linguistic difference regarding the nature of the DistKey. English *each* (and AQs in Dutch, Norwegian, French, Italian, Russian) seem unable to distribute over pluralities of events, or other abstract entities (facts, situations, etc) (cf. 7ab). In contrast, German *jeweils* (and AQs in Korean and Bulgarian) can do so (cf. 8ab).

- (7) a. *Peter praised and criticised Mary for two reasons *each*.
(OK with *respectively*)
b. *One apple *each* was rotten.
intended reading: ‘One apple was rotten each time / in each basket.’
- (8) a. Peter lobte und kritisierte Maria aus *jeweils* zwei Gründen.
Peter praised and criticised Maria for each two reasons
‘Each of Peter’s praising Mary and his criticising her happened for two reasons.’
b. *Jeweils* ein Apfel war verrottet.
each one apple was rotten
‘One apple was rotten each time / in each basket etc..’

2.3. *Goals*

Given the two problems in 2.1 and 2.2, the paper is structured as follows. Section 3 provides a surface-compositional analysis of AQs. In particular, it will be argued that AQs are instances of regular quantifiers after all. Section 4 accounts for the general possibility of event-related readings with AQs, which was illustrated in (8ab). Section 5 accounts for the cross-linguistic difference regarding the availability of such event-related readings illustrated in (7) and (8).

3. A Surface-Compositional Analysis of Anti-Quantifiers as Quantifiers

3.1. *Basic Assumptions*

In this section, I argue that a surface-compositional interpretation of the sentences in (1ab) is possible given a number of syntactic and semantic assumptions. The analysis is based on the assumption that the internal structure of the DP containing the AQ is more complex than meets the eye. In this section, I lay out the general assumptions for the compositional analysis of AQs. In 3.2, I show how the meaning of DPs containing AQs is derived. In 3.3, I show how the meaning of such DP combines with the remainder of the clause.

The fourth assumption is that the prepositional head P^0 denotes a relation variable 'R'. 'R' establishes a distributive relationship between DistKey and DistShare. 'R' is co-indexed with an overt relation-denoting expression that provides it with its semantic value.² In the case of (1ab), the overt relation-denoting expression is the transitive verb *buy*. As a result, the distributive relation between individual boys and sets of three sausages is one of buying, and not, say, of eating, craving etc.

3.2. The Denotation of each-DPs

In this section, I claim that *each*-DPs are interpretable as in (12).³ I assume that the distributive effect is due to the presence of a Skolem function (type $\langle e, e \rangle$). The semantic nature of the Skolem function is determined by the denotation of PrP, which denotes a set of such Skolem functions). The Skolem function maps elements of the restriction to elements of the DistShare in a way specified by 'R':

- (12) *Semantic Analysis, Part I:*
- a. $[[\text{Pr}+\text{P}]] = \lambda Q_{\langle e, t \rangle} \lambda P_{\langle e, t \rangle} \lambda f_{\langle e, e \rangle}. Q(\lambda x. P(f(x)) \ \& \ R_j(f(x))(x))$
- b. $[[\text{Q}_{\text{PEach-e}_i}]] = \lambda P. \forall z [z \in Z_i \rightarrow P(z)]$ by FA of $[[\text{each}]]$ to $[[e_i]]$
- ↓ by FA of (12a) to (12b)
- c. $[[\text{Pr}^0+\text{P}^0 \text{ each-e}_i]] = \lambda P_{\langle e, t \rangle} \lambda f_{\langle e, e \rangle}. \forall z [z \in Z_i \rightarrow (P(f(z)) \ \& \ R_j(f(z))(z))]$
- ↓ by FA of (12c) to $[[\text{three sausages}]]$
- d. $[[\text{PrP three sausages each-e}_i]] = \lambda f. \forall z [z \in Z_i \rightarrow (3\text{sausages}'(f(z)) \ \& \ R_j(f(z))(z))]$
- ↓ by FA of $[[D^0]]$ to (12d) (with $[[D^0]] = \lambda F. \exists f F(f)$)
- e. $[[\text{DP } D^0 \text{ three sausages each-e}_i]] = \exists f [\forall z \in Z_i \rightarrow (3\text{sausages}'(f(z)) \ \& \ R_j(f(z))(z))]$

As can be seen from the right-hand expression in (12e), *each*-DPs denote open propositions. The *each*-DP in (12e) is true iff there is a Skolem function f , such that f maps each element z of a given set Z into a set of three sausages such that a certain relation R_j holds between z and its function value.

The assumption that *each*-DPs are proposition-denoting is supported by the fact that there are other proposition-denoting DPs, even in English. Consider the constructions in (13).

- (13) a. [One apple $[_{\text{PP}}$ on every plate]] is too much / sufficient.
'It is too much/ sufficient that there be one apple on every plate.'
- b. [John singing the Marseillaise] annoyed me,
'It annoyed me that John sang the Marseillaise.'

The subject DP in (13a), which arguably has the same structure as the DP in (11a) modulo an overt preposition, seems to be the semantic argument for propositional operators such as *too much*, or *sufficient*. Such operators normally take arguments of type $\langle t \rangle$, i.e. propositions. Being the only potential argument, the subject DP in (13a) should be of type $\langle t \rangle$ as well, as indicated by the paraphrase. Similarly, Abney (1987) analyses the bracketed ACC-ing gerund in (13b) as a DP although its denotation seems to be the proposition that John sang the Marseillaise. According to Abney (1987:143), the only noun-phrase property of ACC-ing gerunds is their external syntactic distribution.

The existence of proposition-denoting DPs is by no means restricted to English. To the contrary, proposition-denoting expressions with the syntactic distribution and/or other properties typical of DPs (case marking, nominal classifiers) are cross-linguistically attested. In Finnish, embedded clauses under certain verbs of saying or believing can carry an accusative marker on the non-finite verb.⁴

- (14) a. Luul-i-n [teidän tunte-va-n isoglossin käsitteen].
 believe-past-I you_{pl}-GEN know-ptc-ACC isoglosses notion
 ‘I thought that you knew the notion of isoglosses.’
 (Hakulinen & Karlsson 1979)
- b. Metsästäjä ampui lehmä-n. (Hakulinen & Karlsson 1979)
 hunter shot cow-ACC
 ‘The hunter shot the/a cow.’

In Tsez, the verb of an embedded clause can carry a noun class marker.

- (15) enir [užā magalu bāc’ruḏi] r-iyxo
 mother boy bread.III.ABS ate].IV IV-know
 ‘The mother knows that that the boy ate the bread.’
 (Bobaljik 2001, ex. 14a, citing Polinsky & Potsdam 2001)

This concludes the brief excursus on proposition-denoting DPs across languages. The data in (13) – (15) constitute evidence on favour of analysing *each*-DPs as being propositional in nature.

3.3. Combining the Meanings of *each*-DP and its Syntactic Sister

It still needs to be shown how *each*-DP and its syntactic sister combine semantically. I assume that the meaning of the *each*-DP combines with the meaning of its sister by means of the semantic rule in (16):

- (16) *Index-triggered λ-Abstraction* (inspired by Bittner 1994):
 If the semantic types of a proposition-denoting expression α and its syntactic sister β do not match, and if $[[\alpha]]$ contains a free variable u_i which shares its index ‘i’ with β , λ -abstraction in $[[\alpha]]$ over index ‘i’ is licensed, and $\lambda u_i. [[\alpha]]$ is a value of α .⁵

The rule in (16) is not restricted to the interpretation of *each*-DPs. To the contrary, it can be employed elsewhere, e.g. in the interpretation of moved elements (cf. 17a), or hanging topics (cf. 17b).

- (17) a. [_{IP} Peter_i [_{VP} t_i bought a car]]
 b. Jan_i, [_{CP} den_i habe ich gestern t_i gesehen].
 Jan the_{ACC} have I yesterday seen
 ‘As for Jan, I have seen him yesterday.’

In a way, (16) can be perceived as a generalisation of the idea behind Heim & Kratzer’s (1998) rule for interpreting moved constituents. In (18), it is shown how application of (16) allows for a correct interpretation of (17b), where the hanging topic has not been moved to sentence-initial position, but is base-generated in this position (cf. e.g. Weerman 1988). This goes to show that the rule in (16) has a wider range of applications than Heim & Kratzer’s rule.⁶

- (18) a. [[den_i habe ich gestern t_i gesehen]]
 = $\exists e$ [seen'(I, x_i, e) \wedge at'(e, yesterday)]
 \Downarrow *λ -abstraction triggered by (16)*
 b. [[den_i habe ich gestern t_i gesehen]]
 = $\lambda x_i.$ $\exists e$ [seen'(I, x_i, e) \wedge at'(e, yesterday)]
 \Downarrow *FA of (18b) to [[Jan_i]]*
 c. [[Jan_i, den_i habe ich gestern gesehen]]
 = $\exists e$ [seen'(I, jan', e) \wedge at'(e, yesterday)]

(18c) is true iff there is an event of the speaker seeing Jan that took place yesterday.

With (16) in place, we can proceed to the second part of the semantic analysis of (1a). The meanings of *each*-DP and V in (1a) combine by λ -abstraction over index ‘j’ of ‘R_j’ in [[DP]], followed by functional application of the result to [[V]] (which provides the ‘content’ of the distributive relation). This is illustrated schematically in (19)

- (19)
-
- $\rightarrow \lambda$ -abstraction over ‘i’ & FA
 $\rightarrow \lambda$ -abstraction over ‘i’ & FA
 $\rightarrow \lambda$ -abstraction over ‘j’, plus FA

- b. [*Jeweils_{i,j} ein Apfel*]₁ [_{VP} *t₁ war verrottet*].
 each one apple was rotten
 ‘One apple was rotten each time / in each basket etc..’

4.1. Distribution over VP-conjuncts

The semantic derivation of (22a) is analogous to that of (1ab), the difference being that universal quantification ranges over a plurality of event predicates. The DistKey in (22a) is a plural event (predicate) of praising and criticising that is denoted by the “pluralised” VP-conjunction. The denotations of the two conjoined VPs combine to form a plural predicate (over events) by Krifka’s (1990) mechanism of plural predicate formation (cf.23d). The DistShare *zwei Anlässen* ‘two occasions’ denotes sets of two occasions on which the individual subevents took place. The relation variable ‘R’ gets its semantic value under co-indexation not with a transitive verb, but with the preposition *bei* ‘at’.

- (23) a. [[*jeweils_{i,j} zwei Anlässen*]]
 $= \exists f [\forall z [z \in Z_i \rightarrow (2\text{occasions}'(f(z)) \wedge R_j(f(z))(z))]]$
 \Downarrow λ -abstraction over index ‘j’ (triggered by co-indexation on *bei*)
 b. [[*jeweils_{i,j} zwei Anlässen*]]
 $= \lambda R. \exists f [\forall z [z \in Z_i \rightarrow (2\text{occasions}'(f(z)) \wedge R(f(z))(z))]]$
 \Downarrow FA of (23b) to [[*bei*]] = $\lambda x \lambda e. \text{at}'(x, e)$
 c. [[_{PP} *bei jeweils_{i,j} zwei Anlässen*]]
 $= \exists f [\forall z [z \in Z_i \rightarrow (2\text{occasions}'(f(z)) \wedge \text{at}'(f(z), z))]]$
 d. [[_{VP} *t₁ gelobt und kritisiert*]] *by plural predicate formation*
 $= \lambda E. E = e_1 \oplus e_2 \wedge \text{praised}'(u_2, v_1, e_1) \wedge \text{criticised}'(u_2, v_1, e)$
 \Downarrow λ -abstraction in (23c) over index ‘i’ (triggered by index on VP)
 e. [[_{PP} *bei jeweils_{i,j} zwei Anlässen*]]
 $= \lambda Z_i. \exists f [\forall z [z \in Z_i \rightarrow (2\text{occasions}'(f(z)) \wedge \text{at}'(f(z), z))]]$
 \Downarrow Predicate Modification (PM) of (23d) and (23e)
 f. [[[*bei_j jeweils_{i,j} zwei Anlässen*] [*t₂ t₁ gelobt und kritisiert*]_i]]
 $= \lambda E. E = e_1 \oplus e_2 \wedge \text{praised}'(u_2, v_1, e_1) \wedge \text{criticised}'(u_2, v_1, e) \wedge$
 $\exists f [\forall z [z \in E \rightarrow (2\text{occasions}'(f(z)) \wedge \text{at}'(f(z), z))]]$
 \Downarrow repeated λ -abstraction over indices ‘1’ and ‘2’, FA to object and subject denotation, existential closure over the complex event variable *E*
 g. [[(22a)]] = $\exists E [E = e_1 \oplus e_2 \wedge \text{praised}'(\text{peter}', \text{maria}', e_1) \wedge$
 $\text{criticised}'(\text{peter}', \text{maria}', e) \wedge \exists f [\forall z [z \in E \rightarrow (2\text{occasions}'(f(z)) \wedge$
 $\text{at}'(f(z), z))]] = 1$ iff

- h. there is a plural event E consisting of two subevents of Peter praising Mary, and of Peter criticising Mary, and for each subevent z there is a function f such that $f(z)$ is a set of two occasions at which z happened.

(32h) is true iff each of the two subevents happened at two occasions. These are the correct truth-conditions for (22a).

Notice that the semantic derivation of (22a) differs from that of (1) in that the DistKey is a plural predicate, not a plural individual. As a result, the semantic value of the adjoined event modifier *bei jeweils zwei Anlässen* ‘on two occasions each’ and the plural VP combine not by functional application, but by predicate modification. A parallel state of affairs holds in the nominal domain for examples such as (24), where a PP-modifier containing the AQ *jeweils* combines with the plural nominal predicate *Listen* ‘lists’.

- (24) Die [[Listen] [mit jeweils drei Namen]] wurden herumgereicht.
 the lists with each three names were passed.around
 ‘The lists with three names each were passed around.’

It seems, then, that distribution with AQs over pluralised predicates is a general option.

4.2. Distribution over Implicit Sets of Events

For the semantic interpretation of (22b), we need one more semantic rule. The second rule of λ -abstraction is given in (25).

- (25) *Type-Triggered λ -Abstraction:*
 If the semantic types of a proposition-denoting expression α and its syntactic sister β do not match, and if $[[\alpha]]$ contains a free variable u_i of the same semantic type as β , λ -abstraction in $[[\alpha]]$ over index ‘i’ is licensed, and $\lambda u_i. [[\alpha]]$ is a value for α .

The DistKey in (22b) is an implicit set of events provided by the context. The DistShare is constituted by individual apples. The value of ‘R’ is a relation between individuals and events (= the VP-denotation after λ -abstraction over index ‘1’ of the subject trace). (26) shows how the derivation of (22b) proceeds. The crucial steps in the derivation are (26b) and (26d). Application of index-triggered λ -abstraction to the VP-denotation yields a relation-denoting expression in sister position to the *jeweils*-DP. This relation-denoting expression, in turn, can trigger type-triggered λ -abstraction over the relation variable R_j in the denotation of the *jeweils*-DP.

- (26) a. $[[[_{VP} t_1 \text{ war verrottet}]] = \lambda e. \text{rotten}'(x_1, e)$
 \Downarrow *by index-triggered λ -abstraction over index ‘1’*
 b. $[[[_{VP} t_1 \text{ war verrottet}]] = \lambda x_1 \lambda e. \text{rotten}'(x_1, e)$

- c. $[[_{DP}jeweils_{i,j} \text{ ein Apfel}]]$
 $= \exists f [\forall z [z \in Z_i \rightarrow (1 \text{ apple}'(f(z)) \wedge R_j(f(z))(z))]]$
 \Downarrow *by type-triggered λ -abstraction over index 'j'*
- d. $[[_{DP}jeweils_{i,j} \text{ ein Apfel}]]$
 $= \lambda R_j. \exists f [\forall z [z \in Z_i \rightarrow (1 \text{ apple}'(f(z)) \wedge R_j(f(z))(z))]]$
 \Downarrow *by FA of (26d) to (26b)*
- e. $[[[Jeweils_{i,j} \text{ ein Apfel}]_1 t_1 \text{ war verrottet}]]$
 $= \exists f [\forall z [z \in Z_i \rightarrow (1 \text{ apple}'(f(z)) \wedge (\lambda x_1 \lambda e. \text{rotten}'(x_1, e)) (f(z))(z))]]$
 $= \exists f [\forall z [z \in Z_i \rightarrow (1 \text{ apple}'(f(z)) \wedge \text{rotten}'(f(z), z))]] = 1 \text{ iff}$
- f. there is a function which maps all elements z of a contextually salient set of events onto individual apples such that $f(z)$ is rotten in z .

(26f) is true iff, in every relevant event/situation, there was a rotten apple. The derivation in (26) is special in that (type-triggered) λ -abstraction in the left-hand sister of a mother node (here: the *jeweils*-DP) is contingent on the application of (index-triggered) λ -abstraction in the right-hand sister (here: the VP). In Zimmermann (in prep.) the entire process as a whole is called ‘crosswise λ -abstraction’.

In conclusion, the derivation of “event-related” readings with *jeweils* is analogous to that of the basic case in (1). Necessary ingredients of the analysis are the two rules of λ -abstraction in (16) and (24), the semantic analysis of *each*-DPs from section 3, and the semantic mechanisms of functional application, predicate modification and existential closure over events.

5. Accounting for Cross-Linguistic Differences with AQs

So far, the cross-linguistic problem from section 2 has not been solved. The question raised there was why a language like English (or French, Italian, Dutch, Russian, Norwegian) does not allow for event-related readings with anti-quantifiers.

Two observations will help us to arrive at a solution to this problem. The first observation concerns a correlation between the morphological shape of the AQ in a given language and the possibility of event-related readings in that language. In a first class of languages (henceforth: class I–languages), namely in English, Dutch, French, Italian, Norwegian, and Russian, the AQ is formally identical to the regular adnominal D-quantifier corresponding to *each*. The AQs in these languages do not give rise to event-related readings, as shown for Dutch, French and Italian in (27a-c).

- (27) a. *Piet heeft Marie om *elk* twee redenen bekritiseerd en geprezen. [Du.]
 P. has M. for each two reasons criticised and praised
 b. *Peter a adulé et critiqué Marie pour deux raisons *chacun/e*. [Fr.]
 Peter has praised and criticised Mary for two reasons each_{masc/fem}

- c. *Peter ha apprezzato e criticato Maria per due ragioni *ciascuno/a*. [It.]
Peter has praised and criticised Maria for two reasons each_{masc/fem}

In a second class of languages (class II –languages), the AQ differs formally from the regular adnominal D-quantifier. This is the case in German, where the AQ *jeweils* differs from the quantifier *jeder* ‘each, every’, in Korean, where the AQ –*ssik*- differs from the quantifier *kak...mata* ‘every’, and in Bulgarian, where the AQ *po* differs from the quantifier *vseki* ‘each’. It turns out that these languages allow for event-related readings with AQs, as shown in section 4 for German, and in (28ab) for Korean and Bulgarian.

- (28) a. Na-nun [phwungsen-hana-ssik-ul] sa-ess-ta [Korean]
I TOP balloon one ACC bought
‘I bought a balloon each time / each day / at each store.’
(Choe 1987:52, ex.18)
- b. Mary byaga *po* 5 mili predi zakuska. [Bulgarian]
Mary runs each 5 miles before breakfast
‘Mary runs 5 miles before breakfast every day.’

The first observation can be summarised in form of the generalisation in (29).

- (29) i. The AQ must distribute over DP-denotations if it is formally identical to the regular adnominal D-quantifier.
ii. The AQ can distribute over non-DP denotations (implicit or explicit pluralities of events) if it is formally different from the regular adnominal D-quantifier.

The second observation is that there is no general sortal (ontological) restriction that forbids the English AQ *each* (and its counterparts in class I-languages) from distributing over events as long as these events are denoted by a DP. In (30), *each* can distribute over the two events denoted by the DP-conjunction.

- (30) [The hailstorm and the accident]_i caused five casualties each_i.

(30) shows that the ban on event-related readings in class I-languages is not semantically motivated, but must be syntactic in nature.

I assume that the ban has to do with the morphosyntactic feature content of the AQs in these languages, which is reflected in their morphological shape (formal identity to the adnominal D-quantifier). In brief, I assume that AQs that are formally identical to regular D-quantifiers contain D-features (person, number, gender), and that these D-features need to be checked against those of their NP-proform complement. In order to acquire D-features, the NP-proform must be co-referent (co-indexed) with a DP-expression. This explains why AQs in class I-languages cannot distribute over pluralities of events that are not denoted by a DP (i.e. events that are either implicit (cf.22b), or denoted by a VP-

conjunction (cf.22a)). It also explains why distribution over pluralities of events is possible as long as these pluralities are denoted by a DP (cf.30).

In contrast, AQs that differ formally from regular D-quantifiers do not contain D-features that need to be checked against those of the NP-proform. It follows that the NP-proform can be co-referent (co-indexed) with any plural expression (plural DP, verb conjunction, implicit set of events). This accounts for the free availability of event-related readings with AQs in class II-languages.

In conclusion, it was shown that the cross-linguistic difference in the availability of event-related readings is syntactic in nature. AQs come in two classes cross-linguistically. In class I-languages they contain D-features that need to be checked against a DistKey DP. In class II-languages, they do not contain D-features and can take any plurality as DistKey.

6. Conclusion & Further Applications

In this paper, it was shown that a surface-compositional treatment of AQ-constructions is possible, and that the term 'AQ' is a misnomer. Anti-quantifiers are quantifiers with an overt or covert proform. The analysis extends to a variety of languages. Cross-linguistic differences exhibited by the construction seem to be syntactic in nature.

Finally, as suggested in Zimmermann (in prep.) the analysis possibly extends to a number of related and (at first sight) unrelated constructions. These are illustrated in (31).

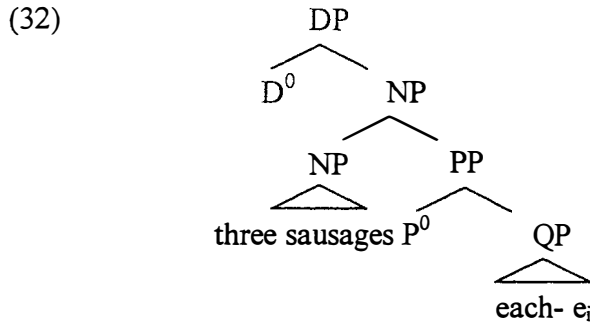
- (31) a. *je+NP constructions in German & per-constructions in English:*
 Benzin kostet drei Mark je Liter.
 petrol costs three marks per liter
- b. *Binding from Inverse Linking Constructions*
 One man in every_i city is rich / despises it_i.
- c. *Variable binding with possessor DPs*
 Every_i man's mother adores him_i.
- d. *Pluractional Prepositional Constructions* (cf.Stockall 2001)
 Girl after girl arrived.

The interested reader is referred to Zimmermann (in prep.) for further details.

Appendix: An Alternative Analysis without Small Clauses

Zimmermann (in prep.) presents an alternative analysis of AQ-constructions that does not make use of DP-internal small clauses. On this alternative analysis, the

postnominal PP containing the QP is base-generated as a postnominal PP-modifier, right-adjoined to NP. The alternative syntactic structure is given in (32).



Semantically, P⁰ and QP are taken to form a lexicalised semantic unit with the denotation in (33):

- (33) a. $[[_{PP} P^0_j \text{ each-}e_i]] = \lambda P. \forall z [z \in Z_i \rightarrow \exists x [P(x) \wedge R_j(x)(z)]]$
- ↓ by FA of (32a) to [[two books]]
- b. $[[\text{three sausages } P^0_j \text{ each-}e_i]]$
 $= \forall z [z \in Z_i \rightarrow \exists x [3\text{sausages}'(x) \wedge R_j(x)(z)]]$
- c. $= [[_{DP} D^0 \text{ three sausages } P^0_j \text{ each-}e_i]]$

On this analysis, the D⁰-head is semantically empty. The rest of the derivation proceeds as in (19)-(21) above (double application of λ-abstraction over indices ‘j’ and ‘i’, followed by functional application to the values of transitive verb, and subject (trace) respectively).

The advantage of the alternative analysis is that it allows for a unified analysis of adnominal *jeweils* and adverbial *jeweils* in German. (34) contains an instance of adverbial *jeweils*, for which a small-clause analysis seems implausible.

- (34) Peter hat *jeweils* gewonnen.
 Peter has each-time won ‘Peter won each time.’

The semantic value for *jeweils* in (33a) extends to instances of adverbial *jeweils* on the assumption that Z_i is co-indexed with a contextually salient set of events, x ranges over events, and R a (contextually determined) relation between two events (e.g. subpart, temporal overlap/ succession)

On the other hand, there is also a disadvantage to the alternative analysis. It treats AQs such as *jeweils* as special (possibly grammaticalised) forms with a particular (double quantifier) semantics. This may be plausible for the morphologically marked form *jeweils*, but less so for English *each*.

Endnotes

¹ The constituency of AQ and DistShare is confirmed by standard constituent tests. For instance, both elements can be displaced together, as shown in (i).

(i) One interpreter each₁ was assigned t₁ to the visiting diplomats.

² Relation variables are put to use in the analysis of genitive expressions by – among others - Partee (1983/97), Partee & Borshev (1998), Barker (1998). The relation variable with AQs differs from the relation variable with prenominal genitives, which is always semantically free and contextually bound, in that it is normally assigned a fixed value in the course of the semantic derivation.

³ I take the trace of the preposition to have no effect on the semantic derivation.

⁴ In Turkish, this is the regular strategy for clausal complements (cf. Kornfilt 1997).

⁵ At first sight, the formulation in (16) poses a problem for compositionality (Chris Barker, p.c.). The meaning of the node consisting of α and β cannot be derived by looking at the meanings of α and β alone. For λ -abstraction to go through, the co-indexed free variable must be visible at the stage of the derivation where α and β combine, which it is not. Apparently, the semantic derivation must look “into” the meaning of α , of which the variable forms a part, a process not in line with compositionality. However, Dekker (1993:165f.) shows that the apparent problem for compositionality can be overcome by using partial assignment functions. See also Dekker 1998:332, fn.5, on the special case of the assignment function assigning the empty set. (Ede Zimmermann, p.c.).

⁶ (16) differs from Heim & Kratzer’s rule in that it does not ensure an unambiguous mapping from syntactic structure to interpretation. This fact is captured by the formulation “[...] is a value for α ” in (16). In other words, the notation ‘[[α]]’ is not unambiguously defined. The problem is ameliorated by the fact that (16) only applies in cases where the combination of α and β is uninterpretable otherwise, due to type mismatch. This ensures that the mother node of α and β has an unambiguous reading in almost all cases (it either receives no interpretation, or it receives the interpretation resulting from λ -abstraction). Nevertheless, there is a configuration in which application of (16) could lead to ambiguity on the mother node in principle. The situation arises when both sisters α and β are proposition-denoting, α is co-indexed with a free variable in the denotation of β , and β is co-indexed with a free variable in the denotation of α . The situation is given schematically in (i)

(i) [[α_i] [β_j]
 (x_j) (y_i)

In this situation, λ -abstraction as in (16) can apply either to α (over index ‘j’) or to β (over index ‘i’). Independent of the question of whether this configuration actually arises, one should keep in mind that applying (16) to (i) results in the

derivation of a family of readings that is passed up in the semantic derivation, rather than in the derivation of an unambiguous reading (Ede Zimmermann, p.c.).

⁷ For expository reasons, I have slightly altered the example in (8a) to (22a). This is because (8a) is not fully transparent semantically. The preposition *aus* ‘from’ in the PP-modifier *aus...Gründen* ‘for...reasons’ seems to have lost its original meaning. Instead, the causal relational meaning is provided by the NP-complement *Gründen* ‘reasons’. In contrast, (22a) is fully transparent, with the preposition *bei* denoting the local relation AT.

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