Universität Potsdam
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MM3 Cross-Linguistic Semantics
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3 – Quantification

0. Intro

Q1: Was für syntaktische und semantische Unterschiede gibt es zwischen den quantifizierenden Elementen *zwei* und *jeder* in (1ab)?

(1) a. Zwei Studenten kamen herein.

b. Jeder Student kam herein.

Q2: Gibt es semantische Unterschiede zwischen (2a) und (2b)?

(2) a. **Most** students left for Paris.

b. The students **mostly** left for Paris.

1. Adnominal Quantifiers: The Classical View (Montague 1973, Barwise & Cooper 1981)

- All quantified expressions are determiner-heads that combine with NPs to denote *generalized quantifiers* of type <et,t>

(3)

$$\begin{array}{ccc} & \text{DP } \langle et,t\rangle & \\ \text{D}_Q & & \text{NP} \\ \text{every} & & \text{painting} \\ \langle et,\langle et,t\rangle\rangle & & \langle et\rangle \end{array}$$

- Quantifying determiners denote 2nd-order relations between sets of individuals:

(4) a. $[\![DP]\!] = [\![D]\!]([\![NP]\!])$

b. $[[D_Q]] = \lambda P_{<et>}.\lambda Q_{<et>}.\ P\mathbf{R}Q$

(5) a. $[[\text{every}]] = \lambda P_{<et>}.\lambda Q_{<et>}.\ P \subseteq Q$

b. $[[\text{two}]] = \lambda P_{<et>}.\lambda Q_{<et>}.\ |P \cap Q| \geq 2$

(6) a. $[[\text{every student came in}]] = [[\text{student}]] \subseteq [[\text{came in}]]$

$= 1 \text{ iff } \forall z\ [\text{student}(z)]: \text{came\_in'}(z)$

b. $[[\text{two students came in}]] = |\ [[\text{student}]] \cap [[\text{came in}]]\ | \geq 2$

$= 1 \text{ iff } \exists x\ [\text{student}(x) \wedge |x| \geq 2 \wedge {}^*\text{came\_in'}(x)]$

2. Universals in Adnominal Quantification

2.1 Conservativity

- The range of logically possible relations between sets that can be expressed by natural language determiners is restricted by the semantic property of *conservativity* (or: *live-on property*).

(7) *Conservativity:*

for arbitrary sets A,B: Det(A)(B) ⇔ Det(A)(A∩B)

→ The result of applying the determiner meaning to its two set arguments is equivalent to applying the determiner meaning to the first set argument A (the NP-denotation) and the intersection of first and second argument $A \cap B$

→ as a result, only the NP-denotation A and the intersection of A with B, i.e. $A \cap B$, are relevant for establishing the truth-conditions of a sentence;

Elements of B that are not in A do not matter for the interpretation !

→ conservativity implies that the NP-denotation A is more important than the second set B (typically the VP-denotation): *quantifiers live on A*

- *Empirical test for conservativity*

There is a simple empirical test for conservativity. A determiner Det applied to an NP and a VP is conservative if the following equivalence holds:

(8) *Det NP VP* is true iff *Det NP is a/ are NP(s) that VP* holds

(9) a. Some students smoke. ⇔ Some students are students that smoke.

b. Every student smokes. ⇔ Every student is a student that smokes.

c. No student smokes. ⇔ No student is a student that smokes.

d. Two students smoke. ⇔ Two students are students that smoke.

- *Formal Proof for Conservativity:* some

(10) some (A)(B) = 1 iff $A \cap B \neq \varnothing$ (meaning of *some*)
⇔ $A \cap A \cap B \neq \varnothing$ (set theory: $A = A \cap A$)
⇔ $A \cap (A \cap B) \neq \varnothing$
= 1 iff some(A)($A \cap B$) (meaning of *some*)

→ The criterion of conservativity makes a clear prediction as to which of the logically possible quantifiers can occur as quantifiers in natural language.

By doing so, it restricts the number of logically possible determiner denotations from **65536** to **512** in a model with only two individuals.

- *Prediction*

There are no equivalences of the form Det(A)(B) ⇔ Det (A∩B)(B), where the meaning of the NP-complement A in its entirety does not play a role for the semantic interpretation:

(11) Every beer drinker is a student. ≠ Every beer drinking student is a student.

→ *Example:* The logically possible quantifier *schmevery* in (12a) with the meaning in (12b) is not attested in English, and cross-linguistically (?), even though the meaning is plausible and not difficult to compute, cf. (13):

(12) a. **Schmevery** student drinks beer = 1 iff
b. every beer drinker is a student: [[beer drinker]] $\subseteq$ [[student]])

(13) a. [[schmevery]] = $\lambda A \in \wp(D).\ \lambda B \in \wp(D).\ B \subseteq A$

b. [[schmevery student]] = $\lambda B \in \wp(D).\ B \subseteq$ [[student]]

c. [[schmevery student drinks beer]] = 1 iff [[beer drinker]] $\subseteq$ [[student]]

- Formal proof that *schmevery* is not conservative:

(14) i. the inference from left to right is valid:

schmevery(A)(B) = 1	iff	$B \subseteq A$	(meaning of *schmevery*)
	$\Rightarrow$	$A \cap B \subseteq A$	(set theory)
	iff	schmevery(A)($A \cap B$) =1	(meaning of *schmevery*)

ii. the inference from right to left is invalid:

schmevery (A)($A \cap B$) = 1 iff $A \cap B \subseteq A$ (meaning of *schmevery*)
$/\!/\!\Rightarrow$ $\mathbf{B \subseteq A}$
iff schmevery(A)(B) = 1

From $A \cap B \subseteq A$ it does not follow automatically that $B \subseteq A$!

Q3: What about the semantics of *only* in *Only Students are beer drinkers*?

→ *Only* is an adverbial, and not a D-head ! The universal rule does not apply !

Q4: What about the following Polish quantifiers discussed in Zuber (2004)?

(15)

2.2 Some B&C-Universals

U3: Every natural language has conservative determiners.

→ compatible with the existence of (some) non-conservative quantifiers in (some) languages

U1: Every natural language has DPs that denote Generalized Quantifiers

(16) *Determiner Universal:*

Every natural language contains basic expressions (called *determiners*) whose semantic function is to assign to common noun denotations (i.e., *sets*) A a quantifier that lives on A (Barwise & Cooper 1981: 179).

BUT: *The universal does not stand up to closer scrutiny as …*

i. Not all languages have adnominal quantifiers that map NP-denotations onto Generalized Quantifiers → Lillooet Salish (Matthewson 2001), see §3

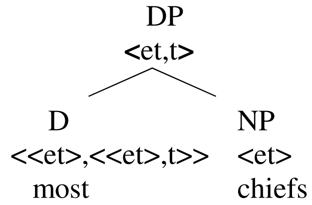
ii. Not all languages feature genuine adnominal quantifiers (Jelinek 1995, Baker 1995), §5

3. Variation in the Domain of Genuine Adnominal Quantification: D+NP vs. D+QP

Lillooet Salish (St'át'imcets) vs. English (Matthewson 2001)

- standard GQ-analysis of adnominal quantifiers:

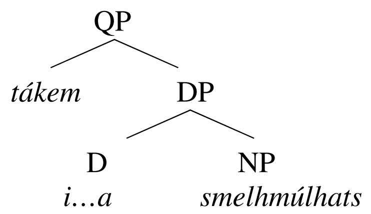
(17)



- *The problem:*
  In Lillooet Salish (aka St'át'imcets) constructions as in (17) are systematically ungrammatical: *Adnominal quantifiers do not combine with NPs, but with DPs*!

(18) a. **tákem** [**i** smelhmúlhats-**a**]
all DET.PL woman(PL)-DET
'all the women'

b.



Q5: How is the structure in (18b) interpreted?

3.1 Basic facts about DPs in St'át'imcets (Matthewson 2001)

i. All arguments require the presence of an overt determiner

(19) a. q'wez-ílc [**ti** smúlhats-**a**]
dance-INTR DET woman-DET
'The/a woman danced.'

b. * q'wez-ílc [smúlhats]
dance-INTR woman

ii. Determiners must be absent on all main predicates, including nominal predicates.

(20) a. **kúkwpi7** [kw-s Rose]
chief DET-NOM Rose
'Rose is a chief.'

b. * [**ti** kúkwpi7-**a**][kw-s Rose]
DET chief-DET DET-NOM Rose
'Rose is a / the chief.'

- Quantifiers inside arguments always co-occur with determiners:

(21) a. léxlex [tákem i smelhmúlhats-a]
intelligent all DET.PL woman(PL)-DET
'All (of) the women are intelligent.'

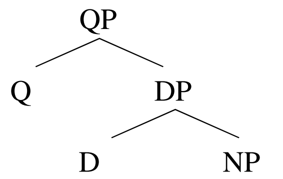
b.*léxlex [tákem smelhmúlhats]
intelligent all woman(PL)
'All women are intelligent.'

(22) a. úm'-en-lkhan [**zí7zeg' i** sk'wemk'úk'wm'it-a] [ku kándi]
give-TR-1sg.subj each DET.PL child(PL)-DET DET candy
'I gave each of the children candy.'

b.*úm'-en-lkhan [**zí7zeg'** sk'úk'wm'it/ sk'wemk'úk'wm'it] [ku kándi]
give-TR-1sg.subj each child / child (PL) DET candy
'I gave each child / each (of the) children candy.'

- Structure for quantified arguments in St'át'imcets (see also Demirdache et al. 1994, Matthewson & Davis 1995, Matthewson 1998):

(23)



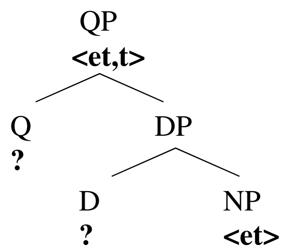
3.2 Semantic analysis

- Interpreting (23):

i. NPs in St'át'imcets denote (one-place) predicates, cf. (20a).

ii. The entire QP in St'át'imcets denotes a generalized quantifier (Matthewson 1998)

(24)

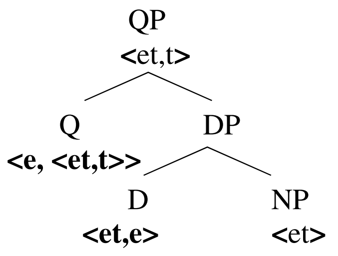


Q6: What are the semantic denotations of the functional heads in D and Q?

iii. As DPs never function as predicates in St'át'imcets (cf.23b), quantifiers in St'át'imcets combine with sisters of argumental type: **type(DP) = <e>**.

iv. D-heads in St'àt'imcets denote variables over choice functions, which apply to the NP-set and choose one (singular or plural) individual from the set denoted by the NP predicate: **type(D) = <et,e>**.

(25)



v. St'àt'imcets adnominal quantifiers take an individual and a predicate as semantic arguments, and quantify over the atomic subparts of that individual:

(26) *Distributive universal quantifier:*

a. [[zí7zeg']] = $\lambda x_{<e>}. \lambda Q_{<et>}. \forall y \leq x$ [atom(y) $\rightarrow$ Q(y)]

zí7zeg' takes an individual and a predicate and specifies that every atomic subpart of that plural individual satisfies the predicate.

b. [[zí7zeg' i smelhmúlhats-a qwatsáts]]
each DET women(PL)-DET leave 'Each woman left.'

= 1 iff for all y which are atomic parts of the plural individual of women that is chosen by the choice function g(k), y left.

- *Conclusions:*

i. Adnominal quantifiers in St'àt'imcets do not denote relations between two sets (<et,<et,t>>), as would be expected on the standard GQ-analysis. Rather, their first argument is of type <e>.

ii. the creation of a generalized quantifier proceeds in two steps: (i.) the creation of an individual (DP-denotation), *which depends on the context*; (ii.) the quantification over the subparts of this plural individual

→ the two-step procedure is reminiscent of the two interpretive steps (domain restriction, and GQ-formation), which appear to take place simultaneously in English

3.3 How to deal with this semantic variation?

- *Two options:*

i. In line with the Transparent Mapping Hypothesis, adnominal quantifiers in St'àt'imcets and English exhibit macro-variation in that quantifiers denote semantic objects of different type. This semantic difference is reflected by differences in the surface syntax of quantified expressions in the two languages.

ii. In line with the Universal Hypothesis, the systems of adnominal quantification in the two languages do not differ. As the standard GQ-analysis for English does not extend to St'àt'imcets (the complement DPs in St'àt'imcets can never be interpreted as predicates), perhaps one can re-analyse English quantification in the light of the St'àt'imcets facts?

→ option (ii.) is stronger and may give rise to new and unexpected insights into the quantificational system of English

4. Weak vs. Strong Quantifiers, with special attention on Hausa

4.1 Weak and Strong Quantifiers (Kamp 1981, Heim 1982, Kamp & Reyle 1993)

Q7: Should all quantifying expressions be semantically analysed as GQs?

- *Observation:*
The at first sight homogenous class of quantifying expressions falls into two groups that differ in a number of semantic (symmetry-asymmetry, quantificational variability, binding) and syntactic respects (+/- occurrence in existential *there*-sentences):

(27) a. Two students drink beer. = Two beer drinkers are students. *(+/- symmetric)*
b. Every student drinks beer. ≠ Every beer drinker is a student.

(28) a. A_i / $Some_i$ student came late. He_i apologized. *(+/-cross-sentential binding)*
b. *$Every_i$ student came late. He_i apologized.

(29) a. If a student gets a $question_i$, he answers it_i. *(+/- donkey pronouns)*
b. *If a student gets $every_i$ question, he answers it_i.

(30) a. There is a unicorn in the garden. *(+/- existentials)*
b. *There is every unicorn in the garden.

- *Two kinds of adnominal quantifying expressions*:

i. Genuine quantifiers, which map NP-denotations (i.e. sets or predicates) on GQs, (31a).

ii. Modifying elements that inherit their apparent quantificational force from a covert c-commanding existential quantifier (viaEC)

(31) a. [[every]] $= \lambda P_{<et>}.\lambda Q_{<et>}.\ P \subseteq Q$

b. [[two]] $= \lambda x.\ |x| \geq 2$

→ This semantic distinction corresponds to the traditional distinction into +/- existential quantifiers (Keenan 1987), or *weak and strong quantifiers* (Milsark 1977):

(32)

weak quantifiers	*a*, *sm* (unstressed form of *some*), numerals, *mny*, *few*, … (indefinites)
strong quantifiers	*every*, *each*, *all*, *most*, *sóme*, *féw*, *mány*

2.4 Weak and Strong Quantifiers and Transparent Mapping

- There is some evidence that the different interpretation of weak and strong quantifiers is correlated with a different syntactic status:
  i. Genuine adnominal quantifiers are determiner heads, cf. (7).
  ii. Quantificational modifiers are adjectival in nature (Hoeksema 1983, Higginbotham 1987)

(17)

NP **<et>** ⇑ Predicate Modification

A two **<et>** — NP students <et>

- Quantificational modifiers in English:

  i. can be preceded by the definite determiner (plus other adjectives) (cf. 18a),
  ii. or by strong quantifiers (in D) (cf. 18b),
  iii. can function as predicates (cf. 18c).

(18) a. the (notorious) *two* arguments against UG
b. every *two* weeks
c. His sins were *many*.

2.5 Weak and Strong Quantifiers in Hausa (West Chadic, Nigeria/ Niger)

- *Observation:*
  In Hausa, the evidence for two kinds of adnominal quantifying expressions is even more direct (Zimmermann 2005):

  i. Hausa weak quantifiers behave syntactically like non-quantifying NP-modifiers

  ii. Hausa weak quantifiers differ from strong quantifiers, which occur in a different syntactic position and show no parallels to non-quantifying modifiers

- *Weak Quantifiers in Hausa* = elements occurring in indefinite NPs:

(19) i. numerals: *daya* 'one', *biyu* 'two', *ukù* 'three', cf. (20ai,ii)
ii. many: *dà yawàa, màasu yawàa*, cf. (20b)
iii. few: *kàd'an*, cf. (20c)

(20) ai. yaaròo **d'aya**
boy one
'one boy'

ii. dàalibai **biyu** / **ukù** (postnominal)
students two three
'two/ three students'

b. maataa **dà /màasu** **yawàa**
women with /owner.pl quantity
'many women'

c. birai **kàd'an**
monkeys few
'a few monkeys'

- Weak quantifiers show the same behaviour as NP-modifiers (adjectives, PPs):

  i. Weak quantifiers occur in the same *postnominal position* as adjectives and PP-modifiers, cf. (21a-c).

  ii. Some of them (*da yawàa*, *màasu yawàa*) employ the same linkers as other modifiers, cf. (21bc).

  iii. Weak quantifiers can be followed by modifying adjectives, cf. (22a).

  iv. Weak quantifiers can occur in predicate position, cf. (22b).

(21)	a. gidaa	**farii**			'white house'	(cf. 20ai.ii)
	house	white				
	b. yaaròo	***dà***	**sàndaa**		'boy with a stick'	(cf. 20b)
	boy	with	stick			
	c. yaaròo	**mài**	**hùulaa**		'boy with a cap'	(cf. 20c)
	boy	owner-of	cap			
(22)	a. mootoocii	**bìyar**	jaajàayee		'five red cars'	
	cars	five	red			
	b. maata-nsà	**hud'u**			'His wives are four.'	
	wifes-his	four				

→ As modifying expressions, weak quantifiers *denote (second order) properties and are of type <e*,t>*

- Strong quantifiers occur in DP-initial position and show head-like behaviour (e.g. gender/number agreement with head noun).

(23) a. *koowànè* / *koowàcè* / *koowàd'ànnee* 'each, every (m./f./pl.)' = ∀

i. **koowànè**$_{masc.}$ d'aalìbii 'every student'
ii. **koowàcè**$_{fem}$ mootàa 'every car'

b. *wani* / *wata* / *wa(d'an)su* 'some (other), a certain (m./ f./ pl.)' = ∃

i. **wani**$_{masc}$ mutûm 'some man'
ii. **wata**$_{fem}$ màcè 'some woman'
iii. **wa(d'an)su**$_{pl}$ mutàanee 'some men' = 'some people'

→ *Strong quantifiers are functional elements in a head position*. As functional elements, they can be analysed as genuine quantifiers *of type* <*et*, <*et,t*>>. (cf. 7)

- ***Conclusions***

i. Typologically unrelated languages exhibit two kinds of adnominal quantifying expressions: genuine quantifying expressions (in D) and adjective-like, modifying expressions.

ii. The existence of adjective-like, modifying quantifying expressions makes a good candidate for a semantic universal (*and a good topic for a typologically oriented paper!*)

Q: To what extent do languages have strong adnominal quantifiers of type <et, <et,t>>?

5. Variation 2: D- vs. A-Quantifiers