First African Summer School in Linguistics
Syntax-semantics Interface and Cross-Linguistic Variation: Session III
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Session III: Quantification and DP-Structure

1. Quantifying Expressions

- *Central Observation:*

  Many natural language have a class of nominal expressions that can serve as syntactic arguments, but which are not saturated in the sense that they would refer to specific individuals: QUANTIFYING DPS

(1) a. *Everybody / every student* danced.

b. *Nobody / no student* danced.

c. *Two students* / *less than five students* danced.

d. *Most students* danced.

- Differences between Quantifying DPs and referring expressions

  Quantifying DPs as in (1) differ from proper referring expressions ([[proper names]]) in a number of ways**:**

i. Some quantifying DPs violate the *Law of Contradiction* (Aristotle):

(2) An affirmative clause and its negated counterpart cannot simultaneously be true:

$\neg (p \wedge \neg p)$

(3) #*Malte* is in Accra now and *Malte* is not in Accra now. → CONTRADICTION vs.

(4) *At least twenty students* are in Accra now and *at least twenty students* are not in Axccra now. → CONTINGENCY (i.e. TRUE OR FALSE, depending on circumstances)

BUT: This does not hold for all quantifying DPs

(5) *Every student* is in Accra now, and *every student* is not in Accra now.

can only be true in a universe without any students.

iii. Some Quantifying DPs violate the Law of the Excluded Middle (Aristotle):

(6) A sentence must be either true or false:

$p \vee \neg p$

(7) Peter is older than 30 years or Peter is not older than 30 years. → TAUTOLOGY vs.

(8) Every man is older than 30 years or every man is not older than 30 years.

→ CONTINGENCY (i.e. TRUE OR FALSE, depending on circumstances)

iii. Syntactic movement of quantifying DPs across other operators (quantifiers, modals, negation) induces differences in interpretation.

(9) a. Almost everyone adores Claudia Schiffer.

b. Claudia Schiffer$_1$, almost everyone adores t_1.

(10) a. Almost everyone solved at least one exercise.

b. At least one exercise, almost everyone solved.

- *Conclusions:*

i. Quantifying DPs differ semantically from individual-referring expressions of type <e> and must therefore be of a different semantic type.

ii. Quantifying DPs are not of type <e> and thus do not refer to individuals.

2. Adnominal Quantifiers: The Classic View

- Quantifying DPs denote semantic objects of type <et,t> , i.e. second order properties over predicates: GENERALIZED QUANTIFIERS (Montague 1973, Barwise & Cooper 1981)

(11) [S <t> [DP every student <et,t>] [VP danced <et>]]

→ In (11), it is the quantifying subject DP that act as an unsaturated function in mapping a 1place-function from individuals to truth values onto a truth value.

- The meaning of some quantifying DPs:

(12) a. $[\![\text{nobody}]\!] = \lambda f \in D_{et}$. There is no $x \in D_e$ such that $f(x) = 1$.

b. $[\![\text{everybody}]\!] = \lambda f \in D_{et}$. For all $x \in D_e$, $f(x) = 1$.

c. $[\![\text{somebody}]\!] = \lambda f \in D_{et}$. There is some $x \in D_e$ such that $f(x) = 1$.

or in SET NOTATION:

(13) a. $[\![\text{nobody}]\!] = \lambda P \in \wp(D)$. There is no $x \in D_e$ such that $x \in P$

b. $[\![\text{everybody}]\!] = \lambda P \in \wp(D)$. For all $x \in D_e$, $x \in P$.

c. $[\![\text{somebody}]\!] = \lambda P \in \wp(D)$. There is some $x \in D_e$ such that $x \in P$

($\wp(D)$ = the power set of D)

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

(14) [DP <et,t> [D_Q every <et, <et,t>>] [NP student <et>]]

- Quantifying determiners denote 2^{nd}-order relations between sets of individuals

(15) *General Scheme:* TRIPARTITION

Det [Restriction$_{NP}$] [Nuclear Scope$_{VP}$]

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

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

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

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

c. $[[\text{no}]] = \lambda P_{<et>}.\lambda Q_{<et>}.\ P \cap Q = \varnothing$

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

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

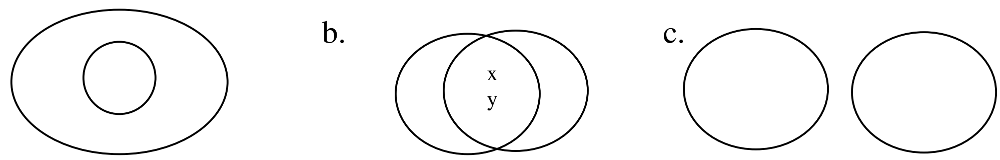
b. $[[\text{two students came in}]] = |\ [[\text{student}]] \cap [[\text{came in}]]\ | \geq 2$

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

c. $[[\text{no student came in}]] = [[\text{student}]] \cap [[\text{came in}]] = \varnothing$

$= 1 \text{ iff } \neg\exists x\ [\text{student}(x) \wedge \text{came\_in'}(x)]$

(19) a. b. c.



every NP VP two NPs VP no NP VP

3. Universals in Adnominal Quantification

3.1 Conservativity

- The range of logically possible relations between sets expressable by natural language determiners is restricted by the formal property of *conservativity* (or: *live-on property*).

(20) *Conservativity:*

for arbitrary sets A,B: $\text{Det}(A)(B) \Leftrightarrow \text{Det}(A)(A \cap B)$

→ 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:

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

(22) 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

(23) 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 ($A \cap B$)(B), where the meaning of the NP-complement A in its entirety does not play a role for the semantic interpretation:

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

→ *Example:* The logically possible quantifier *schmevery* in (25a) with the meaning in (25b) is not attested in English, and cross-linguistically (?), even though the meaning is plausible and not difficult to compute, cf. (26):

(25) a. **Schmevery** student drinks beer = 1 iff
b. every beer drinker is a student: [[beer drinker]] ⊆ [[student]])

(26) 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]] ⊆ [[student]]

- Formal proof that *schmevery* is not conservative:

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

schmevery(A)(B) = 1 iff $B \subseteq A$ (meaning of *schmevery*)
⇒ $A \cap B \subseteq A$ (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 !

3.2 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***

(28) *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 feature genuine adnominal quantifiers (Jelinek 1995, Baker 1995), §5

ii. Not in all languages do adnominal quantifiers map NP-denotations onto Generalized Quantifiers → Lillooet Salish: Q + DP (Matthewson 2001), NEXT SESSION

Q: Should all functional elements that CAN be formally anlyzed as Generalized Quantifiers be treated as such from a LINGUISTIC perspective, OR

Do different classes of 'quantifying' expressions behave in different ways?

(29) a. Two students entered the classroom.

b. Each student entered the classroom

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

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

Q: Should all quantifying DPs be syntactically and 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, discourse binding, quantificational variability effects (QVE)) and syntactic respects (+/- occurrence in existential *there*-sentences) (→ DYNAMIC MEANING THEORIES)

(30) *+/- symmetry*:

a. Two students drink beer. = Two beer drinkers are students.
b. Every student drinks beer. ≠ Every beer drinker is a student.

(31) *+/- cross-sentential discourse anphora*

a. **A$_i$ / Some$_i$ student** came late. **He$_i$** apologized.
b. *Every$_i$ student came late. He$_i$ apologized.

(32) *+/- QVE, +/- donkey binding*

a. If **a/some student$_j$** gets **a/some question$_i$**, **he$_j$** answers **it$_i$**.
→ any student, any question: UNIVERSAL QUANTIFICATION

b. *If a student gets every$_i$ question, he answers it$_i$.

(33) +/- QVE

a. You must answer a question. UNIVERSAL READING POSSIBLE

b. You may answer a question. EXISTENTIAL

(33) *+/- Existential Sentences*

a. There is **a unicorn** in the garden.
b. *There is *every unicorn* in the garden.

(34) *+/- Exceptional Wide Scope* (Reinhart 1997)

a. If some relative of mine dies, I will inherit a house.
= There is a certain relative of mine such that if he dies, I will inherit a house.

b. If every relative of mine dies, I will inherit a house.
≠ For every relative of mine, if he dies, I will inherit a house.

- *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 (via **EC**)

(35) 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 1974/77):

(36)

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

4.2 Weak and Strong Quantifiers and Transparent Mapping

Transparent Mapping (Matthewson 2001):

What you see (syntactically) is what you get (for semantic interpretation)

- There is some empirical evidence that the different interpretation of weak and strong quantifiers correlates with a different syntactic status:

i. Genuine adnominal quantifiers are determiner heads = Q-DETS.

ii. Q-MODIFIERS are adjectival modifiers (Hoeksema 1983, Higginbotham 1987)

(36) NP **<et>** ⇑ Predicate Modification

A	NP
two	students
<et>	<et>

⇒ Numeral expressions and other Weak Quantifiers (unstressed *many*, *few*) syntactically and semantically behave like other NP-modifiers

- Q-Modifiers in English = Adjectival Elements

i. can be preceded by the definite determiner (plus other adjectives) (cf. 37a),
ii. or by strong quantifiers (in D) (cf. 37b),
iii. can function as predicates (cf. 37c).

(37) a. the (notorious) *two* arguments against Universal Grammar
b. every *two* weeks
c. His sins were *many*.

BUT: The categorical difference between Q-Dets and Q-Mods is not reflected in linear order in English as both functional expressions and adjectives precede the NP.

Q: What about other languages?

4.3 Q-Dets & Q-Mods in Hausa (West Chadic, Nigeria/ Niger)

- *Observation:*
In Hausa, the difference between strong and weak quantifiers (Q-Dets vs Q-Modifiers) is transparently reflected in word order (Zimmermann 2008):

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

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

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

(38) i. numerals: *daya* 'one', *biyu* 'two', *ukù* 'three', cf. (36ai,ii)
ii. many: *dà yawàa, màasu yawàa*, cf. (36b)
iii. few: *kàd'an*, cf. (36c)

(39) 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 other NP-modifiers (ADJs, PPs):

i. Weak quantifiers occur in *postnominal position*, as do As and PP-modifiers, cf. (40a-c).

ii. Some of them (*da yawàa*, *màasu yawàa*) employ the same linkers as other modifiers, cf. (40bc).

iii. Weak quantifiers can be followed by modifying adjectives, cf. (41a).

iv. Weak quantifiers can occur in predicate position, cf. (41b).

(40)	a.	gidaa **farii**		‘white house’	(cf. 39ai.ii)
		house white			
	b.	yaaròo ***dà*** **sàndaa**		‘boy with a stick’	(cf. 39b)
		boy with stick			
	c.	yaaròo **mài** **hùulaa**		‘boy with a cap’	(cf. 39b)
		boy owner.sg cap			
(41)	a.	mootoocii **bìyar** jaajàayee		‘five red cars’	
		cars five red			
	b.	maata-nsà **hud’u**		‘His wives are four.’	
		wifes-his four			

→ As Q-Mods, weak quantifiers *denote (second order) properties of pluralities and are of type <e*,t>*

- Genuine quantifiers (=Q-Dets) occur in DP-initial position and show head-like behaviour, e.g. gender/number agreement with head noun.

(42) a. *koowànè / koowàcè / koowàd’ànnee* ‘each, every (m./f./pl.)’ = ∀

i. **koowànè**$_{\text{masc.}}$ d’aalìbii ‘every student’
ii. **koowàcè**$_{\text{fem}}$ mootàa ‘every car’

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

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

→ *Strong quantifiers are functional elements in a functional head position*. As Q-Dets, they can be analysed as genuine quantifiers *of type <et, <et,t>>*, (cf. 3)

- ***Conclusions***

i. Typologically unrelated languages exhibit two kinds of adnominal quantifying expressions: genuine quantifying expressions in D, aka *Q-Dets*, and adjective- or PP-like modifiers, aka *Q-Mods*.

ii. The set of Q-Dets is just a very small subset of the set of quantifying expressions in the wider sense: *each, every, most*, and Q-Dets do not seem to be attested cross-linguistically; see §5

iii. The existence of Q-Mods makes a good candidate for a semantic universal (*and a good topic for further research*), see e.g. the papers in Matthewson (2008).

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

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

- Central Observation:

  B&C's U1 & U3 are incorrect: There are languages in which quantificational concepts can only be expressed by indefinites (plus EC), quantifying predicates (*to be two*) (= weak quantifiers), **A(dverbial)-quantifiers**, Q-verbs etc., see Bach et al. 1995:

- *A New Universal* (Jelinek 1995: 511):

  "While all languages have A-quantification, only some languages have D-quantification. English has both types" ; see (2ab)

  "While A-quantification is unselective, the function of D-quantification is to fix the quantifier scope to a particular argument position" (Jelinek 1995: 532)

- *Languages without D-quantification*:

  Mohawk (North America, Baker), Navajo, Lakhota (North America, Faltz 1995), Mayali (Australian, Evans 1995), Strait Salish (North America, Jelinek 1995), Asurini do Trocara (Guarani/ South America, Damaso Viera 1995), Kalaallisut (Bittner & Trondhjem 2008)

→ Most of these languages are polysynthetic PROARG-languages, in which grammatical properties of subject and object arguments are registered in form of affixal pronouns on the verb. Any overt lexical DPs are adjoined (topics) and coreferent with one of the pronominal argument affixes under co-indexation.

→ In PROARG-languages, all overt lexical NPs must be referring expressions (SESSION I):

(43)	a. Shawátis	shako-núhwe'-s	Uwári	b. ≈ $John_1$, he_1 likes her_2, $Mary_2$
	John	MsI/FsII-like-hab	Mary	
	'John likes Mary.'			

→ True D-quantifiers are not referring and cannot be co-indexed with, nor bind a pronoun in argument position:

(44) a. *$Nobody_1$, I know him_1 in this city. b. *$Everybody_1$, he_1 entered the bar.

→ Genuine quantifying DPs are generally impossible in PROARG-languages for the same reason why they cannot be left-dislocated in English/German.

- *Quantification in Strait Salish* (Jelinek 1995):

i. weak quantifiers (cardinals, *many*, *few*, etc.) are predicates:

(45)	**čəsə' = 0**	cə	q^{w}əq^{w}el'
	two = 3ABS	DET	speak

'They are two, the (ones who) spoke.' ≈ 'Two persons spoke.'

ii. strong quantifiers (e.g. universal quantifiers) are unselective A-quantifiers :

(46)	**mək'^{w}** = ł	w'	<u>n</u>a-t	tsə	sčenx^w	(universal quantification)
	all=1plu	LINK	eat-TR	DET	be.fish	

i. We ate **all the fish.** ii. **We all** ate fish.
iii. **We all** ate **all the fish**. iv. We **ate** the fish **up** completely.

→ other unselective A-quantifiers/intensifiers in Strait Salish: *yas* ‘always’, *čəlel* ‘almost’, ‘*ən’an* ‘very, too’, *x^{w}əw’e* ‘never’

(47) λ’e’ = sən ‘əw’ t’əm’-t-0 (additive particle)
AGAIN-1sNOM LINK hit-TRAN-3ABS

i. I hit him **again**. ii. I **also** hit him.

→ (46iii) and (47) suggest a close link between apparent quantification over the nominal domain and aspectual quantification over the verbal domain; see the discussion of Q-verbs in Bittner & Trondhjem (2008)

•	***Conclusions***:
i.	Some languages do not seem to have Q-Dets for principled grammatical reasons.
ii.	They can compensate for this lack by a number of strategies, most prominently A-quantifiers, which are often, but not necessarily *unselective* (see Evans 1995 on Mayali).
iii.	All languages have **non-D**-quantifiers → Are these conservative ???

⇒ The compensating power of A-quantifiers is not so exotic, even from the English perspective:

(48) a. **Most** students left for Paris.
b. The students **mostly** left for Paris.

6. Research Assignments

i. Determine the meaning of (49ab) in a step-by-step fashion, by making use of the semantic representations in (17) and (18):

(49) a. No student failed.
b. More than three students passed.

ii. Determine the inventory of quantifying expressions in your language.

iii. If the language has adnominal quantifying expressions determine whether they fall into the same two classes (Q-Dets vs. Q-Mods) as their English counterparts by means of the diagnostics in 4.1, by considering word order facts (see discussion of Hausa), and by comparing their behaviour with that of genuine NP-modifying expressions.