

Quantificational strategies across language modalities

Josep Quer

ICREA-Universitat Pompeu Fabra, Barcelona
josep.quer@upf.edu

Abstract. The study of quantification traditionally focused on structures where quantificational meanings are encoded in determiners. Only as a later development attention was paid to quantificational strategies that rely on adverbs, or affixes. In this paper I discuss three varieties of quantificational strategies attested in two sign languages (ASL and LSC) and argue that even the apparent instances of determiner quantification in those languages make use of the more “constructional” way of encoding quantificational meanings that partially reflect the mapping onto tripartite structures overtly. Further, lexical quantification is addressed in the domain of distributivity.

Keywords. Quantification, sign languages, D-quantification, A-quantification.

1 Introduction

The study of quantification in natural language traditionally focused on structures where quantificational meanings are encoded in determiner-like elements in the nominal domain. This bias results from circumscribing the empirical range of inquiry to Indo-European languages, and mostly to English. This tendency was only countered relatively recently by cross-linguistic research by formal linguists on less studied or undescribed languages, the most prominent examples of it being Bach et al.’s (1995) and Matthewson’s (2008) volumes. The works presented there make a clear case for reconsidering the inherited research agenda on the basis of theoretical analysis of a broader and typologically and genetically more diverse set of languages, as descriptive grammars usually lack the level of detail and theoretical insight required for solid crosslinguistic semantic inquiry.

Sign languages (SLs) have only become the object of systematic linguistic analysis in the past few decades, with very irregular coverage of description and a rather limited language sample. American Sign Language (ASL) has been the most thoroughly studied one. However, semantics is the least well-known area of SL grammars, let alone from a formal semantics perspective.¹ This applies to the grammar of quantification, as well, with the exception of Partee (1995) and Petronio (1995) on ASL. The present paper aligns with those two works in two senses:

¹ For a sample of the few exceptions in the study of different topics in the semantics of sign languages, see the works by J. Quer, Ph. Schlenker, R. Wilbur, A. Zucchi, for instance, as well as those referenced in the text on quantification in SLs.

- It explores the ways in which language modality (visual-gestural vs. aural-oral) might have an impact on the expression of quantificational meanings in natural languages. It resorts to the main divide proposed in Bach et al. (1995), namely quantification expressed in the nominal domain by the determiner system vs. quantification conveyed through other means like adverbials or affixes (D- vs. A-quantification, see below for details). Following Heim (1982) and Partee (1992, 1995), tripartite structures are taken as the unifying generalization across those two types of quantifying strategies in natural language.
- It brings SLs to the forefront of the discussion by providing new and unpublished data from Catalan SL (LSC) (Quer 2005) and by comparing it with parallel phenomena described and analyzed in ASL.

This study confirms that the two SLs under discussion display very similar ways of encoding quantification, both of the D- and A-types. It is suggested that the more constructional way of expressing quantified meanings in SLs could be related to the discourse-oriented character of their surface structures, which makes mapping into tripartite structures partially transparent.

Section 2 presents the basic ingredients of the D- vs. A-quantification divide and sets up the stage for the sections to follow. Section 3 addresses A-quantification structures in LSC that support the hypothesis that tripartite quantificational structures are a common means to encode quantificational meanings overtly. Section 4 tackles D-quantification in LSC and argues that the relevant part of the restriction gets overt marking. Section 5 discusses affixal quantification in the verb and points towards an analysis as pluriactional marking. The paper concludes with general considerations drawn from the empirical and theoretical discussion.

2 D-Quantification vs. A-Quantification

The classical analysis of quantification relied on the properties that quantified nominal expressions of the form ‘*every/most/some N*’ have in languages like English. The most prominent representative of this view is probably Generalized Quantifier Theory in Barwise & Cooper (1981). However, a whole line of inquiry into quantification was initiated by Lewis and developed by Kamp (1981) and Heim (1982) on the basis of quantificational readings triggered by adverbs like *always* or *usually*, as in (1a), which can be paraphrased as (1b). What (1b) does is make the quantificational structure explicit. The quantificational relation is represented in a more abstract or general format in a tripartite structure as in (2).

- (1) a. A quadratic equation usually has two different solutions.
b. Usually, x is a quadratic equation, x has two different solutions.
- (2) Operator [Restrictor] [Nuclear scope]

In a Kamp/Heim type of analysis, the indefinite NP *a quadratic equation* introduces an open variable without quantificational force. The open variable is unselectively bound by the quantificational adverb (Q-adverb) *usually*. This operator binds the unbound instances in the restrictor and in the nuclear scope. The virtual equivalence of (1a) to a sentence like *Most quadratic equations have two different solutions*, featuring a D-quantifier instead of a Q-adverb, has led to developing a very fruitful avenue of research on quantification from both a theoretical and a descriptive point of view, as natural languages turn out to vary significantly in the ways they realize quantification, well beyond encoding it solely in the NP/DP domain.

Partee et al. (1987) coined the terms *D-quantification* to refer to the “classical” nominal quantified nominal phrases that resort to the determiner system, next to *A-quantification*. The latter is used to denote a cluster of other quantificational coders, namely Adverbs, Auxiliaries, Affixes, and Argument-structure adjusters that “can be thought of as alternative ways of introducing quantification in a more ‘constructional’ way” (Partee 1995: 544).

A further development in this approach has been the attempt to understand the interaction of information structure partitioning and quantificational structure, as in Partee (1992, 1995) and Bach et al. (1987). The main thrust behind this connection is to understand how topic/focus determines the projection of material onto a tripartite structure. Partee (1995: 545-546) expresses this generalized view of tripartite structure as in Figure 1, featuring “a number of hypothesized syntactic, semantic, and pragmatic structures that can be argued to be correlated with each other and with the basic tripartite scheme.” The underlying motivation of this analytical tool lies in the fact that a broad range of quantificational structures show focus-sensitivity. It should be kept in mind, though, that syntactic constraints override the generality of tripartite structures, thus leading to more complex mappings from syntax to semantics.

In what follows it will be argued that relevant evidence from SLs (LSC and ASL) provides further support for the proposed view. With this limited sample, it is shown that languages in the visual-gestural modality remain within the limits attested crosslinguistically in this specific domain of the syntax/semantics-pragmatics mapping.

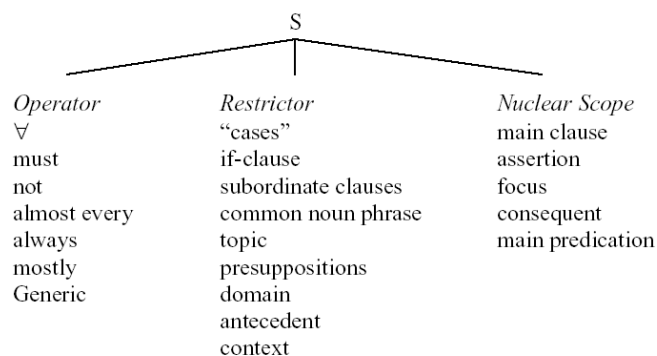


Fig. 1. Tripartite structures generalized (Partee 1995)

3 A-Quantification structures in SLs

3.1 With overt operators

Conditional and generic statements with indefinite descriptions are typical instances where quantificational variability is attested in the presence of overt Q-adverbs. LSC is no exception in this respect. Note that the language marks familiar or specific DPs by means of an accompanying index (cf. also Barberà 2011): nominal descriptions bound unselectively by a generic or habitual operator appear as bare nouns in the conditional antecedent, as in (3).² The arguments in the consequent of (3) are not realized by pronouns and the potentially inflecting verb TAKE-CARE displays a neutral form without overt marking for object agreement.

- (3) $\overline{\hspace{10em}}_{\text{br}^3}$
 [IF PEASANT HORSE THERE-BE] SURE TAKE-CARE
 ‘If a farmer has a horse, he certainly takes care of it.’

It seems quite uncontroversial to posit that antecedent and consequent instantiate here the restrictor and the nuclear scope of a tripartite structure, respectively (restrictor indicated with square brackets). Following much work in the dynamic approaches to such cases, we take SURE in (3) to lexicalize a modal epistemic necessity operator that raises at the level of LF and unselectively binds the argument variables within its scope. The same kind of interpretation is triggered by Q-adverbs, as in (4):

- (4) $\overline{\hspace{10em}}_{\text{br}}$
 [IF PEASANT HORSE THERE-BE] ALWAYS TAKE-CARE
 ‘If a farmer has a horse, he always takes care of it.’

Generic statements (understood as characterizing sentences in the sense of Krifka et al. 1995, thus also encompassing habitual predications) have been argued to be overtly marked in ASL by the manual sign TEND (Wilbur 1998, Wilbur & Patschke 1999), as exemplified in (5). Parallel structures in LSC in (6) feature the sign ÉS that characterizes this type of statements. It can be argued that such specialized signs lexicalize the generic operator in these languages.

- (5) $\overline{\hspace{10em}}_{\text{br}}$
 LION SELF:CL1 #PREDATORY TEND [ASL]
 ‘The lion is a predatory cat.’
- (6) a. $\overline{\hspace{10em}}_{\text{br}}$
 IX JAPAN EARTHQUAKE ÉS++ [LSC]
 ‘Japan is in a seismic area.’

² For a recent detailed treatment of donkey-sentences of the ‘bishop’ variety in ASL and LSF (French SL), see Schlenker (2011).

³ Standard conventions for glossing SL data are followed here: manual signs are represented with a gloss in capital letters roughly corresponding to the sign; a tier above the manual signs indicates the scope in the coarticulation of non-manual signals like ‘br’ (brow raise), ‘bf’ (brow frowning) or ‘hs’ (headshake). +++ indicates reduplication. # signals fingerspelling.

- b. $\overline{\hspace{1.5cm}}$ br
 LLEÓ DEPRENDAR+++ ÉS
 ‘The lion is a predator.’

3.2 Without overt operators

As predicted in the framework of generalized tripartite structures, no overt operator is required for them to obtain if the relevant contextual and morphosyntactic conditions are met. LSC example (7) is an instance of a generic or habitual predication. The nominal description in the antecedent and the lack of any indication of episodicity in the main predication allow for it. Note that the antecedent has no overt manual introducer and is only flagged by brow raise (see Wilbur & Patsche 1999 and Wilbur 2011 for extensive arguments in favor of analyzing brow raise as the marker of restrictions of non-Wh operators in ASL).

- (7) $\overline{\hspace{2.5cm}}$ br
 [FRIEND PERSON COME] IX1 3-INVITE-1
 ‘If/When a friend comes, I treat him/her.’

Non-conditional generic predications essentially rely on the same ingredients: non-episodicity, lack of index marking of the generic subject and presence of brow raise on it, as in (8):

- (8) $\overline{\hspace{1.5cm}}$ br $\overline{\hspace{1.5cm}}$ hs
 [WOMAN] PLAY LIKE NOT
 ‘Women don’t like to play.’

In both types of examples it is legitimate to argue that the interpretation is the result of the licensing of a covert generic operator GEN that unselectively binds the open argument variables (cf. Krifka et al. 1995).

The structures reviewed in this section constitute an example of transparent mapping of quantificational sentences onto tripartite structures: the conditional antecedent and the brow-raise marked subjects correspond to the material in the restrictive clause of the cover operator (indicated with square brackets), while the rest is trivially projected into the nuclear scope. What is often trivially dubbed as topic-marking with brow raise is claimed to actually flag the restriction of the tripartite structure.

4 D-Quantification and partial overt realization of tripartite structures

The SLs under study display D-quantifiers which can form regular quantificational phrases. A strong tendency to split the noun and the quantifier has been identified in both ASL and LSC, where the nominal restrictor occurs either in argument position or

in a left-peripheral position marked with brow raise, as in ASL (9a) (examples adapted from Boster 1996, Partee 1995, Petronio 1995). Note that when the quantifier restriction appears in situ, the quantifier cannot be left-detached (9b).

- (9) a. $\overline{\text{BOOK I WANT ALL/SOME/THREE}}$
 b. *ALL/SOME/THREE I WANT BOOK

A related, though different, kind of split is observed with restricted Wh-phrases, where syntactic rightward movement of the Wh-sign in LSC strands the restriction in argument position or else the restriction appears in the left periphery marked with brow raise again, as in (10a) and (10b) respectively. Similar structures have been attested in ASL (Boster 1996) and Indian SL (Aboh et al 2005).

- (10) a. $\overline{\text{IX2 CAR BUY WHICH}}$
 ‘Which car did you buy?’
 b. $\overline{\text{BOOK IX3 READ HOW-MANY}}$
 ‘How many of the books did s/he read?’

However, the type of quantifiers exemplified in (9) and (10) is weak and thus symmetrical in their two arguments, so at face value they do not require a tripartite structure for the computation of their truth conditions under the cardinal interpretation. The Q-N split observed here, though, is arguably the result of their strong or proportional interpretation, which is often taken to arise from the presuppositional set encoded in the nominal restrictor. Under this reading, they are trivially mapped onto tripartite structures. Information structure considerations mark the presuppositional material in the restrictor with brow raise in (9a) and (10a). In addition, in LSC, an SOV language, the default right-edge position of the Wh-element is what determines the surface split of operator and restrictor, thus yielding only a partial resemblance to proper tripartite structured quantification. It remains to be explored whether a covert Focus operator or a Q-typing particle is involved in the quantificational structure, and if so, how.

There is one especially interesting case involving negation. LSC has no proper negative determiners (see Matthewson 2008, and especially Zerbán & Krifka 2008 on Bantu), and the structures we get can be more adequately characterized as cases of A-quantification.⁴ Despite the appearance of a negative determiner in a fragment answer like (11B), it can be shown that the several existing negative markers are sentential operators.

⁴ One note of caution should be included here, as a sign NINGÚ ‘no(ne)’ is attested as a negative adnominal determiner in utterances that are perceived as influenced by Spanish or Catalan. Further research is needed to ascertain whether this is a contact borrowing or it has become integral part of the quantificational system of LSC.

- (11) A: THIS MORNING STUDENT _____bf
 COME WHO
 'Which students came this morning?'
- B: NO-RES2
 'None.'

It can be shown that negative operators behave as adverbial unselective binders that sit in the Specifier of NegP (Quer 2003, Quer & Boldú 2007). As negative operators, they bind the unbound variables of the predicate, be it the event argument (12), the subject (13) or both subject and object arguments in one of the readings of (14). In these examples there is no overt material to be mapped onto the restrictor. Nevertheless, covert contextual information might provide it.

- (12) IX1 _____hs _____hs
 SMOKE NO-RES2
 'I haven't smoked.'
- (13) YESTERDAY NIGHT _____hs _____hs
 COME NO-RES2
 'Noone came last night.'
- (14) _____hs
 BRING NO-RES2
 'Nobody brought anything.'

If an argument of the predicate does not contribute an open variable to the structure, it cannot be unselectively bound by negation, as observed in (15), where only the object slot can be bound by the negative operator (the subject slot is saturated independently):

- (15) _____br _____hs _____hs
 PEOPLE+++ SOME BRING NO-RES2
 'Some people didn't bring anything.'

It is worthwhile noting cases like (16), where ALL appears in the subject description of a negative statement and scopes over negation. The interpretation that obtains confirms the recurrent observation that 'all', as opposed to 'every', is not a proper operator, but rather a predicate indicating exhaustification of the intended set.

- (16) _____br _____hs _____hs
 FRIEND ALL COME NO-RES2
 'No friends came along.'

Still, we do find bona fide strong/asymmetric D-quantifiers that only yield proportional readings like MAJORITY, the equivalent of English *most* in LSC, in (17).

(17) _____br
 STUDENT MAJORITY EXAM PASS
 'Most students passed the exam.'

(18) MOSTx [student(x)] [pass(x)]

This case makes it clear that, when compared to A-quantification, proper cases of D-quantification in SLs impose a less straightforward mapping from overt quantificational statements onto tripartite structures. For basic cases like (17), though, one simply needs to assume that the quantifier will raise at LF to take scope over restrictor (overtly encoded through brow raise above the nominal constituent in the left periphery) and the nuclear scope (the remaining material).

5 Lexical quantification

Under the label A-quantification, a rather heterogenous set of resources to encode quantificational meanings are included in Bach et al. (1995). Verbal affixes of quantificational nature are among them, next to Q-adverbs. Partee (1995) herself actually suggests that A-quantification might not form a natural class and it might need to be further split into true unselective quantifier structures, on the one hand, and lexical quantification applied directly to a verb or other predicate type, on the other. She argues that morphology as operator on the verb can be quite different from unselective binding, because the operator is directed to a specific argument or arguments of the verbs.

In their seminal work on ASL, Klima & Bellugi (1979) analyze and classify a whole set of verbal inflections related to aspect, number and distributivity. Among the last group we find the following:

- [dual]: action with respect to an argument of cardinality two;
- [multiple]: action to many, viewed as a single episode;
- [exhaustive]: distributed action to each individual in a set.

Mostly coinciding with the characterization drawn for ASL by Petronio (1995), the following LSC paradigm illustrates the behaviour of quantificational inflection on the lexical verb and the corresponding interpretations. All of them quantify over the internal argument of the verb. Such inflections are clearly related to what is known as pluriactionals in many spoken languages, but a detailed analysis along these lines is still pending. For a more recent analysis of reduplication in ASL, see Wilbur (2005).

(19) PERSON++ STUDENT IX^TWO IX1 1ASK3[dual]
 'I asked the two students.'

(20) PERSON++ STUDENT IX^THREE IX1 1ASK3[mult]
 'I asked the three students.'

- (21) PERSON++ STUDENT IX^THREE IX1 1ASK3[exh]
 'I asked each one of the three students.'

The exhaustive inflection is also known as *distributive* marking. A crucial fact in this connection is that in LSC the same morphological mechanism is at play in the expression of distributivity on lexical and functional nominal items: the short reduplication along an arc attested in (21), for instance, is the same morpheme that marks distributive-key and the distributive-share in the language (Gil 1995). Typically the reduplicated form of the numeral ONE appears with both functions, but it can also appear on other nominal elements like the possessive (22):

- (22) _____br
 STUDENT ONE+++ TEACHER POSS+++ ASK+++
 'Each student asked his/her teacher.'

Such cases suggest that what might be seen as verbal inflection encoding quantificational interpretations has a more widespread use in the grammar of the language, as a general way of expressing distributivity and pluriactionality.

6 Conclusion

The overview of the data on quantified structures in LSC and ASL tentatively allows to confirm that languages in the visual-gestural modality resort to essentially the same kinds of mechanisms attested for the expression of quantification in spoken languages, namely A- and D-quantification., and A-quantificational structures seem to be widespread. At the same time, this study validates tripartite structures as an important heuristic and analytical tool that helps capture the correlations and correspondences in the different strategies languages employ to encode quantificational meanings.

Acknowledgments. The original work reported in this paper was presented at conferences in 2004/2005. The reviewers of this version and the audience at the 18th Amsterdam Colloquium are gratefully thanked for their feedback and comments. Delfina Aliaga, Santiago Frigola, Josep Boronat and Joan Frigola have contributed as Deaf LSC experts with their intuitions in invaluable ways. This research has been partly made possible by the grants awarded to the author by the Spanish Ministry of Science and Innovation (FFI2009-10492) and to UR-LING by the Govern de la Generalitat de Catalunya (2009SGR00763), as well as by COST Action IS 1006 SignGram.

References

1. Aboh, E., Pfau, R., Zeshan, U.: When a wh-word is not a wh-word: The case of Indian Sign Language. In: Bhattacharya, T. (ed.) Yearbook of South Asian Languages and Linguistics 2005, pp. 11-43. Mouton de Gruyter, Berlin. (2005)

2. Bach, E. et al. (eds.): Quantification in natural languages. Kluwer, Dordrecht (1995)
3. Barberà, G. When wide scope is not enough: Wide scope and topicality in discourse referents. In Proceedings of 18th Amsterdam Colloquium (2011)
4. Barwise, J., Cooper, R. Generalized Quantifiers and Natural Language. *Linguistics and Philosophy*. 4, 159-219 (1981)
5. Boster, C.T.: On the Quantifier-Noun Phrase Split in American Sign Language and the Structure of Quantified Noun Phrases. In *International Review of Sign Linguistics*, Volume 1, Emondson, W.H., Wilbur, R.B., (eds.) pp. 159-208. Lawrence Erlbaum, Mahwah, New Jersey (1996)
6. Gil, D.: Universal Quantifiers and Distributivity. In *Quantification in natural languages*, Bach, E. et al. (eds.) pp. 321-362. Kluwer, Dordrecht (1995)
7. Heim, I.: The Semantics of Definite and Indefinite Noun Phrases. Doctoral dissertation, University of Massachusetts/Amherst (1982)
8. Kamp, H.: A Theory of Truth and Semantic Representation. In *Truth, Representation and Information*, Groenendijk J. et al. (eds.) pp. 1-41. Foris, Dordrecht (1981)
9. Klima, E.S., Bellugi, U.: The signs of language. Harvard UP, Harvard (1979)
10. Krifka, M. et al.: Genericity: An Introduction. In *The Generic Book*, Carlson, G.N., Pelletier, F.J. (eds.), pp. 1-124. The University of Chicago Press, Chicago (1995)
11. Matthewson, L.: Quantification: A Crosslinguistic Perspective. Emerald, Bingley (2008)
12. Partee, B. H.: Topic, Focus, and Quantification. In *SALT I Proceedings*, pp. 159-189. Cornell University: DMLL Publications (1992)
13. Partee, B. H.: Quantificational structures and compositionality. In *Quantification in natural languages*, Bach, E. et al. (eds.) pp. 487-540. Kluwer, Dordrecht (1995)
14. Petronio, K.: Bare noun phrases, verbs and quantification in ASL. In *Quantification in natural languages* Bach, E. et al. (eds.) pp. 603-618. Kluwer, Dordrecht (1995)
15. Quer, J.: Operadores negativos en Lengua de Signos Catalana. Ms. ICREA & Universitat de Barcelona (2003)
16. Quer, J.: Quantifying across Language Modalities: Generalized Tripartite Structures in Signed Languages. Invited lecture at the 1st Workshop on Sign Language. University of the Basque Country/EHU, Gasteiz-Vitoria (2005)
17. Quer, J., Boldú, R.M.: Lexical and morphological resources in the expression of sentential negation in Catalan Sign Language (LSC). In *Actes del 7è Congrés de Lingüística General*, Universitat de Barcelona. CD-ROM, Barcelona (2006)
18. Schlenker, P.: Quantifiers and Variables: Insights from Sign Language (ASL and LSF). In *Formal Semantics and Pragmatics: Discourse, Context, and Model*, Partee, B.H., Glanzberg, M., Skilters, J. (eds.) *The Baltic International Yearbook of Cognition, Logic and Communication*, Vol. 6, (2011)
19. Wilbur, R.B.: Generic and habitual structures in ASL: The role of brow raise. Talk at *Theoretical Issues in Sign Language Research*, Gallaudet University, Washington, D.C. (1998)
20. Wilbur, R.B., Patschke, C.: Syntactic Correlates of Brow Raise in ASL. *Sign Language and Linguistics* 2.1, 3-41. (1999)
21. Wilbur, R.B.: A reanalysis of reduplication in American Sign Language. In: Hurch, B. (ed.), *Studies in Reduplication*, pp. 593–620. De Gruyter, Berlin/New York. (2005)
22. Wilbur, R.B.: Nonmanuals, semantic operators, domain marking, and the solution to two outstanding puzzles in ASL. *Sign Language & Linguistics* 14.1: 148–178. (2011)
23. Zerbian, S., Krifka, M.: Quantification across Bantu languages. In *Quantification: A Crosslinguistic Perspective*, Matthewson, L. (ed.) pp. 383-414. Emerald, Bingley (2008)