On the distributive nature of adverbial *quan* in Mandarin Chinese

Lucia M. Tovena[1] and Yan Li[2]

[1] Université Paris VII
tovena@linguist.univ-paris-diderot.fr
[2] Université Paris VII
liyanlf@hotmail.com

Abstract. The Chinese adverbial *quan* is analysed as an event predicate modifier that can force a distributive reading on a sentence by targetting a nominal that expresses a plural participant in the event, and encapsulating the distributive function in the θ-role associated with such a participant. This solution enables us to model the speakers' intuition of an 'overall evaluation' associated with *quan*.

Keywords: Formal semantics, distributivity, non-differentiation, adverbial *quan* in Chinese

1 Introduction

This paper is about the distributive nature of adverbial *quan* in Mandarin Chinese. *Quan* is a single morpheme[1] that means something like 'all', 'entirely' or 'entire', and can be an adjective (1a,b) or an adverbial (1c,d) (Lü, 1980).[2]

(1) a. Quan ban yiqi qu tubu.
Whole class together go hiking
The whole class goes hiking together.
b. Zhe xilie congshu quan-bu-quan?
DEM collection book complete-negation-complete
Is this book collection complete?
c. Zhe shi quan xin de shu.
DEM be completely new DE book
This is a brandly new book.
d. Zhexie nansheng quan shi wo de boshisheng.
DEM-pl boy all be pro.1sing DE PhD student
These boys are all my PhD students.

[1] In terms of morphology, *quan* can combine with another morpheme and form a new word. Ex. *quan-bu* also means 'all' in Chinese. It can occur either in the determiner position, or the head position of a nominal phrase, or an adverbial position.

[2] Abbreviations used throughout in the glosses: ASP = perfective aspect; ASPExp = experiential aspect; BEI = bei-construction; Cl = classifier; DEM = demonstrative; pl = plural; pro = pronoun; sg = singular.

M. Dong et al. (Eds.): CLSW 2016, LNAI 10085, pp. 497–511, 2016
DOI: 10.1007/978-3-319-49508-8_47

We focus on *quan* with a single semantic type and functioning like an adverb as shown in (1d). In (1d), *quan* is interchangeable with *dou*. More generally, in its adverbial use, *quan* exhibits many syntactic and semantic similarities with *dou*, e.g. it must occur immediately before the verb and it forces a distributive reading of the subject (2) or preverbal object (3), which act as sorting keys (Choe, 1987). They differ insofar as *quan* has a more restricted distribution.

(2) Xuesheng quan/dou pao-le.
Student all run-ASP
The students all ran away.

(3) Zhexie pingguo Mali quan/dou chi-wan-le.
DEM-Pl apple Mali all eat-finish-ASP
These apples, Mali has eaten them all.

Quan has been discussed mainly by comparing it with *dou*, at least in the recent literature on formal linguistics written in English. The role of distributor and/or universal quantifier of the Mandarin Chinese functional morpheme *dou* has been studied extensively, (Lee, 1986; Cheng, 1995; Lin, 1998, i.a.). We acknowledge the relevance of the comparison for their adverbial uses, where there are similarities. However, we consider that one must leave aside the scalar use of *dou*, in the *lian ... dou* construction, because *quan* does not admit a scalar interpretation. We also leave aside cases where adverbial *quan* cooccurs with *dou*, e.g. (4).

(4) Tamen quan-dou huidao-le faguo.
Pro.3.pl all go-back-ASP France
They all went back to France.

In our view, adverbial *quan* is an event predicate modifier that can force a distributive reading on a sentence by targetting a nominal that expresses a plural participant in the event, and encapsulating the distributive function in the θ-role associated with such a participant. This treatment avoids decomposing the distributive quantification into sets of assignments, hence sub-participants and subevents are not accessible. This solution enables us to model a property that could be termed 'wholeness', for want of a better term, that shows in *quan*'s resistance to event differentiation.

The paper is organised as follows. The main properties of *quan* and some of its peculiarities are recalled while discussing previous literature in §2. Next, we look specifically at the distributivity of *quan* in §3 and present cases where the sorting key is a single individual or a bare noun in generic phrases. We also discuss the incompatibility of *quan* with adverbs that differentiate subevents among them. This empirical evidence motivates our analysis in terms of event-

predicate modifier developed in §4. The main contributions of the paper are summarised in §5.

2 The adverbial use of *quan*

Tomioka and Tsai (2005) have claimed that *quan* is not a distributive quantifier by itself. *Quan* is acceptable in a sentence with intrinsically distributive predicates such as *leave*, e.g.(5a), but it is not acceptable in a sentence with an ambiguous predicate that gets only collective reading in the absence of a distributive marker (5b), and acquires distributive only reading when *dou* is present (5c). These data are taken to show that *quan* is compatible with sentences with distributive reading and incompatible with collective reading, and that it is unable to induce distributivity. As a consequence, Tomioka and Tsai (2005) claim that *quan* is a domain regulator that ensures a good fitting cover (Brisson, 1998). The good fitting cover is the value assigned to the domain variable (Cov) of a distributive operator. *Dou* can function as a distributive operator, and *quan* can constrain its domain of quantification. The acceptability of example (5d) is taken to confirm that the acceptability of *quan* depends on the presence of a distributive operator.

(5) a. Tamen quan likai-le.
pro.3.pl all leave-ASP
They all left.

b. *Tamen quan mai-le yi bu chezi.
pro.3.pl all buy-ASP one Cl car
They all bought a car.

c. Tamen dou mai-le yi bu chezi.
pro.3.pl all buy-ASP one Cl car
They all bought a car.

d. Tamen quan-dou mai-le yi bu chezi.
pro.3.pl all buy-ASP one Cl car
They all bought a car.

In their analysis, Tomioka and Tsai also point out that *quan* is unacceptable with a *wh-* in (6) and a *mei* 'every' NP in (7). We come back to these examples when discussing the property of 'wholeness' of *quan*.

(6) shei dou/*quan lai-le
who all come-ASP
Everyone has come.

(7) Mei ge laoshi dou/*quan lai-le.
Every Cl teacher all come-ASP
Every teacher has come.

Tomioka and Tsai's argument for the unacceptability of *quan* in (5b), is rejected by Lee et al. (2013), who ascribe its unacceptability to the 'once-only' interpretation of *buy one x*. In their view, this interpretation is a consequence of the specificity of the object, as NPs with the numeral 'one' tend to have a specific interpretation in Chinese. Lee et al. point out that it is not the case that the buy-type predicates cannot co-occur with *quan*, as shown by example (8), where the numeral is *wu* 'five'.

(8) Tamen quan mai-le wu ben shu
pro.3.pl all buy-ASP five Cl book
They all bought five books.

Lee et al. claim that a treatment of *quan* cast exclusively in terms of domain regulation is inadequate, contra Tomioka and Tsai. They propose that *quan* has two functions, it is a domain regulator when there is a distributivity operator, or else a universal quantifier. Cases like (8), where the predicate, in principle, admits collective and distributive readings, and where there in no overt distributive operator, are instances of *quan* as a universal A-quantifier (Bach et al., 1995). In cases where a distributive operator such as *dou* is overtly present (5d), *quan* is analysed as a domain regulator.

However, Lee et al. do not note the possibility of a kind reading for the nouns phrase in object position in (5b). This reading is not accounted for under their claim is that ungrammaticality follows from the specific only interpretation of postverbal NPs with the numeral *yi* 'one', a claim that cannot apply to (5c) either. Under the kind reading, the sentence is interpreted distributively and more than one buying event of the same type of car can take place. We concede that this reading is subject to speaker variation. Next, Lee et al. also impose a plurality condition that rules out potentially ambiguous predicates with singular objects such as *mai le yi bu chezi* 'buy one car' in (5b). This would account for the difference between (5b) and (8). However, the data are not complete, as plurality is not always required. Singular NPs can play the role of distributive key for *quan*, see (17) below, and (9) from Tomioka and Tsai (2005). Moreover, *yi* can occur in direct object position in a distributive sentence and get non-specific interpretation. The truth conditions of (10) require each child to recite one poem, without specifying whether the same or different poems are recited.

(9) Zhe ben shu wo quan kan-wan-le
DEM Cl book pro.1.sing all read-finish-ASP
I finished reading all parts of this book.

(10) Zhexie haizi quan langsong-le yi shou shige
DEM-pl boy all recite-ASP a Cl poem
All the boys recited a poem.

Sentence (10) needs a more sophisticate approach to predicate classification, one that takes into consideration the properties of thematic roles. The nature of the thematic role discharged by the phrase with *yi* matters, given that *yi* can occur in the distributed share (Choe, 1987) provided the referent of the nominal is not affected. Non-affectedness makes it possible to iterate through all the members of the sorting key in (10). On the contrary, a set of individuals cannot be exclusively separate buyers of the same car, without being sellers in the next buying subevent (5b). From this it does not follow that buying-a-car is a once-only event, since a car can be bought many times. But *buy* being a transfer of possession verb, a car cannot be bought repeatedly in a context where only the buyer is checked to vary systematically.

Now that is clear that cases like (5a), (8) and (10) do not require a double analysis of *quan*, the empirical ground in support of such a distinction reduces to the three specific cases Lee et al. insist on when illustrating where *quan* functions as a universal quantifier, namely when it combines with a collective predicate such as *shi pengyou* 'be friends', see (11); when it quantifies on a domain of degrees such as *quan ping ganjue* 'completely on feeling', see (12); and when it associates with focus in a focus structure, see (13).

(11) Women quan shi tongxue/pengyou.
pro.1.pl all be classmates/friends
We are all classmates/friends.

(12) Ta quan ping ganjue daqiu
pro.3.sg all depend feeling play-ball
He plays ballgames depending totally on his intuition.

(13) Ta quan xie de $[\text{xiaoshuo}]_f$
pro.3.sg all write DE novel
All he wrote are novels.

At least three different collective predicates are discussed by Tomioka and Tsai and Lee et al. They are provided in (11), (14) and (15).

(14) *Women quan shi yi ge da tuanti.
pro.1.pl all be one Cl big group
We are all a big group.

(15) Women quan zai dating jihe.
pro.1.pl all in hall gather
We all gathered in the hall.

Lee et al. tackle the variation between (14) and (15) by endorsing the analysis that Tomioka and Tsai take from Brisson (1998), cast in terms of predicates endowed/not endowed with a DO_{plural} component and invoking a plurality condition. The predicate *jihe* 'gather' has such a subcomponent and example (15)

is fine. On the contrary, the predicate *shi yi ge da tuanti* 'be a big group' doesn't and (14) is out. As for the predicate *shi tongxue/pengyou* 'be classmate/friends', it is said not to have such a component according to such a classification, but (11) is fine. Lee et al. rule this case in by assuming a different analysis of *quan*, namely as a universal quantifier. In short, the grammaticality judgements on the three cases in (11), (14) and (15) require assuming two types of collective predicates and two functions of *quan*, according to Lee et al.

However, the property of symmetry naturally splits collective predicates into the same two groups that yield (un)acceptable sentences when *quan* is added. The predicates *jihe* 'gather' and *shi tongxue/pengyou* 'be classmate/friends' are both symmetric, and sentences (15) and (11) are fine. The predicate *shi yi ge da tuanti* 'be a big group' is not symmetric, and (14) is out. Symmetry is a relevant property because symmetric predicates enforce a strong form of equity among individuals, hence condition (27) discussed below, is bypassed. In short, the acceptability of (11) is not strong evidence for assuming that *quan* plays a distinct function from what it does in (15).

Second, we observe that the case in (12) is much closer to (13) than suggested by Lee et al.'s discussion. Indeed (12) can be understood as 'he plays ballgames only on his intuition', in which case the set of alternatives that is evoked and the whole information structure is close to that of (13). Alternatives are ordered in such a 'only' interpretation, but *quan* is known not to have scalar uses. Example (12) is peculiar also because it may have a syntactic structure that differs from all the other cases, insofar as *quan* takes scope on the right.

Beside the partial similarity with *dou*, a second characteristics of *quan* that has been discussed in the literature concerns a property of wholeness. Zhou (2011) notices that speakers have the intuition of a global predication on the key, and calls it the property *zhengti xing* 'integrity' in Chinese. Zhou's proposal is cast in informal terms and cannot be easily integrated in a formal analysis of *quan*. Furthermore, what he calls 'global predication' must satisfy distributivity anyway, since (16) is true in a situation where twenty five flowers are bought.

(16) Zhe wu ge xuesheng quan mai-le wu duo hua.
DEM five Cl student all buy-ASP five Cl flower
These five students have all bought five flowers.

Lee et al. invoke a set-prominent property when they discuss Tomioka and Tsai's treatment of *wh-* and *mei* cases. Recall that Tomioka et Tsai argue that *quan* is neither distributive nor quantificational, and they do not take a clear stand on the compatibility of *dou* with *wh-*. For them *dou* is either a distributive operator, or an adverb of quantification. As for *mei*, Tomioka and Tsai follow Lin (1996, 1998), according to whom *mei* itself imposes a good-fitting cover

and has a maximality function. As a consequence, *mei* would completely trivialise the function of *quan*, and this accounts for their unacceptable cooccurrence. Following a different approach, Lee et al. argue that the incompatibility of *quan* with *mei* should not be explained in terms of redundancy. They argue that *mei* 'inherently demonstrates an individual-prominent property', and emphasizes that there is no exception among individuals. On the contrary, *quan*, like *suoyou* 'all', is compatible only with quantified NPs with a set-prominent property. As a consequence, they say, 'one cannot attribute the incompatibility between *quan* and *mei* merely to the fact that both can serve as a good-fitting cover to its associated NP and compete for the same NP'. The compatibility of *quan* with the sum operator *suoyou* is taken to show that their semantics share an inherent set-prominent property. As for *wh*-universals, these are said to operate at the level of individuals as well. Hence, they are compatible with the individual-prominent property of *dou*, and incompatible with *quan*.

However, it is not clear how the set-prominent property Lee et al. argue for meshes with the rest of their analysis. They do not explain why the fact that *quan* is a domain regulator should matter for the fact that *mei* has the individual-prominent property. Other unanswered questions are whether *quan* still has such a set-prominent property when it is a universal quantifier, and if it does, what is the difference with a collective reading; and how come *quan* can cooccur with individual-prominent *dou* in sentences like (4).

3 The distributivity of *quan*

3.1 Extending the empirical coverage

The treatment of *quan* must be extended to cover cases where the sorting key is one individual, and a distributive thematic role relates its parts to subevents. This type of data with singular nominals working as key show that *quan* is not just licensed by a distributive predicate or operator, but plays a more active role in bringing about a distributive reading. Let's start by example (17), where there is no obvious source of distributivity alternative to *quan*, and *quan* is acceptable. The book is the sorting key and there is a form of contextually relevant equipartition applied on it, where each cell is a suitable patient in a doodling event. The book is doodled if scribbled pages occur here and there, but a bit everywhere.

(17) Zhe ben shu quan bei luan tu luan hua-le
DEM Cl book all BEI doodle-ASP
This book is all doodled.

Next, consider (18). No obvious difference in meaning is observed between (18) and (19). Furthermore, *dou* is not acceptable in the same context, see (20).

(18) Zhe ge pingguo, Mali quan chi-wan-le.
DEM Cl apple Mali all eat-finish-ASP
This apple, Mali has eaten it all.

(19) Zhe ge pingguo, Mali chi-wan-le.
DEM Cl apple Mali eat-finish-ASP
This apple, Mali has eaten it.

(20) *Zhe ge pingguo, Mali dou chi-wan-le.
DEM Cl apple Mali all eat-finish-ASP
This apple, Mali has eaten it all.

Again, *quan* appears to impose a partition on a participant so that the predicate applies to the cells of the partition, and all the cells are related to subevents by the same thematic role. Further evidence that this is the correct analysis comes from the fact that, if the predication cannot meaningfully apply to the cells, the sentence is out, whether *quan* or *dou* is used, see (21). In (18) each portion of the apple is a patient in the eating event. On the contrary, it is not the case that each portion of the boy in (21) is an 'initiator-theme' in the event of arriving. The contrast between (18) and (20) suggests that it is not the case that the distribution of adverbial *quan* is a proper subset of the distribution of *dou*.

(21) *Zhe ge haizi quan/ dou lai-le.
DEM Cl boy all/ all arrive-ASP
This boy has all arrived.

Moreover, *quan* is acceptable even in a sentence where it is stated explicitly that the domain of the sorting key is an individual and there is an event with a single temporal or spatial trace, which at first sight is a problem for distributivity at large, see (22). By emphasising that every bit of the fish is a patient of my eating, the fact that the whole fish has been eaten gets emphasised too, and vice-versa. This is compatible with my eating the fish in a single go.

(22) Zhe tiao yu, wo yi kou quan chi-le
DEM Cl fish pro.1.sg one mouth all eat-ASP
This fish, I have eaten it all in one mouthful.

Finally, consider generic sentences with bare nouns. *Quan* differs from *dou* insofar as it cannot occur in generic sentences featuring individual-level predicates, e.g. *shi buru dongwu* 'be a mammal' in (23).

(23) a. *Shizi quan shi buru dongwu.
Lion all be mammal
Lions are all mammals.

b. Shizi dou shi buru dongwu.
Lion all be mammal
Lions are all mammals.

Although the unacceptability of (23a) cannot be imputed directly to distributivity, otherwise the acceptability of (23b) would be surprising, we hypothesise that distributivity has got something to do with it. Note that *quan* is acceptable in generic sentences that differ from (23a) in a subtle way, illustrated by (24).

(24) (Na ge xingqiu shang de) Shizi quan shi buru dongwu.
That Cl planet on DE lion all be mammal
Lions (on that planet) are all mammals.

The bare noun *shizi* 'lion' in (23a) intensionally denotes the kind lion, including individuals that exist and that do not exist in specific worlds. The sentence states a definitional characteristics of lions. On the contrary, the denotation of the bare noun in (24) is restricted to lions that exist in that particular planet, because of the modifier that sets the context. In other words, sentence (24) expresses a contingent generalisation, and *quan* is acceptable. The bare noun can act as the sorting key of *quan*, which must be extensional. Another interesting case of contingent generalisation arises with descriptive generics with predicates such as *xihuan* 'like', see (25).

(25) a. Nüren quan xihuan chengshu de nanren.
Woman all like mature DE man
All women like mature men.
b. Meiguoren quan xihuan chi hanbao.
American all like eat hamburger
All Americans love eating hamburgers.

Example (25) illustrates a case of descriptive generic, whereas example (23a) is an *in virtue of* generic, in the words of Greenberg (2006). Greenberg is interested in the type of law-likeness of different forms of generics and in a mechanism to model their exception tolerance. She notes that the *in virtue of* generalisation illustrated by (23a) is true in virtue of a certain property, that the speaker has in mind, and the listener is supposed to accommodate. With descriptive generalisations, speakers do not characterise in what exact sense the possible worlds in which the generalisation is asserted to hold are similar to the actual world. Her distinction is relevant for us insofar as in descriptive generalisations, there is no commitment to an in virtue of factor that would make the proposition hold across worlds. In our view, the assertion is grounded in the contingency of the actual world. This allows us to build a bridge between cases with contextual restrictions such as (24) and descriptive generics such as (25), because it is plausible to assume that in both cases there is an extensional domain that can be the sorting key of *quan*. On the contrary, truly in virtue of generics such as (23a) are intensional and cannot host *quan*.

3.2 Drawing analogies

Adverbial *quan* can impose a distributive reading on a sentence, see (10), but clearly seems to be against event differentiation, as it appears from its incompatibility with adverbs such as *gezi* that differentiate subevents (Yang, 2013), see (26).

(26) *Tamen gezi quan huidao-le Faguo.
pro.3.pl separately all go-back-ASP France
They all went back to France separate ways.

Event differentiation is one of the criteria that current research on scopal properties of distributive lexical items is exploring. The differentiation condition in (27) was proposed by Tunstall (1998) for modelling restrictions on lexically distributive determiners. The distributivity requirement for English *each* is stated to concern the event, which must be completely distributed, and the subevents that make up such a distributed event, which must be differentiated in some way. These two requirements are put together in condition (27).

(27) The Differentiation Condition (Tunstall, 1998)
A sentence containing a quantified phrase headed by *each* can only be true of event structures which are totally distributive. Each individual object in the restrictor set of the quantified phrase must be associated with its own subevent, in which the predicate applies to that object, and which can be differentiated in some way from the other subevents.

For instance, *each* takes inverse scope in the preferred reading of (28a), so that subevents involve different agents and (27) is satisfied. *Every* is not subject to (27), and no preference for wide scope is reported with respect to (28b).

(28) a. A helper dyed each shirt
b. A helper dyed every shirt

The incompatibility of *quan* with *mei*, the equivalent of 'each', can be interpreted as expressing a strong form of non-differentiation. Such a sensitivity is confirmed by the ungrammaticality of *quan* in sentences with other marks of inherent distributivity such as reduplicated classifiers (29).

(29) gege xuesheng dou/*quan mai-le hua.
ClCl student all buy-ASP flower
Each student bought one flower/flowers

Going back to example (26), the event it describes is completely distributed, the subevents are in direct correspondence with the sub-bearers of the thematic

role discharged by the sorting key constituent, and the sentence is unacceptable. Sentence (26) becomes acceptable if *gezi* is taken out, as if subevents were not to be differentiated and predication on the members of the key had to be homogeneous. Which subevent matches which sub-participant is information that should not be accessible if *quan* obeys a strong form of non-differentiation. Sentence (26) might be improved by altering the linear order (Shi Dingxu p.c.), which in Chinese tends to match semantic scope. But although it is slightly better, (30) is not accepted by most speakers.

(30) ?*Tamen quan gezi huidao-le Faguo.
pro.3.pl all separately go-back-ASP France
They all went back to France separate ways

More data confirming the incompatibility of *quan* with a differentiated distributive share, feature the adverbs *fenbie* 'disjointly' (31a), and *fenfen* 'successively' (31b). These examples confirm that no internal difference among subevents can be overtly expressed in the same clause.

(31) a. *Zhexie xuesheng fenbie quan qu-le Bali.
DEM-pl student disjointly all go-ASP Paris
These students all went to Paris seprately.
b. *Zhexie baogaozhe zai huiyi shang fenfen quan fa-le yan.
DEM-pl participant at conference successively all make-ASP speech
These participants all made a speech/speeches at conference successively.

The criterion of event differentiation helps us to make a fresh start on adverbial *quan*. First, non-differentiation gives us a way to characterise the form of homogeneous predication that cannot bring in differences within the key, and that is required by *quan* and incompatible with differentiating quantifiers such as *mei*. This homogeneity is behind the wholeness effect. Second, differentiation always concerns subevents, because *quan*—like floated *all* and unlike binominal *each* and distributive numerals—roughly speaking, need not distributively relate two (sets of) participants, but can do so, compare (5a) and (16). More precisely, the relevant θ-role relates individuals to events, and the individuals may well be the unique expressed participants in those events. This is usually not the case with share markers and binominal quantifiers.

4 A formalisation as event predicate modifier

The incompatibility of *quan* with a differentiated distributed share is reminiscent of the impossibility of having a sentence internal reading of *different* in clauses

containing the distributor *one by one*, see (32) that has only a sentence external reading. The unavailable reading, where recited poems must differ among themselves, is the one that would obey the differentiation condition (27).

(32) The boys recited a different poem one by one.

Brasoveanu and Henderson (2009) build on the reading restriction on (32) to argue for two routes to distributivity, one based on the decomposition of the distributive quantification into sets of assignments, exemplified by *each*, the other based on encapsulation into a function, exemplified by *one by one*. We assume that the ungrammaticality of sentences with *mei* and other forms of inherent distributivity such as reduplicated classifiers, follows from the fact that *quan* encapsulates part of a θ-role function. By modelling *quan* as event predicate modifier that targets a nominal discharging a θ-role, as in (33), we get a unified treatment of the distributivity and of the wholeness of adverbial *quan*.

(33) $\lambda{*}P_{\varepsilon t}\ \lambda e_{\varepsilon}\ [{*}P(e) \wedge \forall x{\in}Part({*}\theta(e))\ \exists e' \leq e\ [\theta(e')=x\ ]\ ]$
where Part is a non-trivial function

In prose, (33) says that *quan* contributes the dependency encapsulated in the θ-role function associated with the targeted participant. It requires the event to be plural, with subevents that are more than one because they are θ-associated with the cells of a non-trivial partition imposed on the referent of the nominal. The domain of the distribution relation is made of the cells of the partition returned by the function Part applied to $*\theta$(e), and the subevents are the range. The temporal dimension being irrelevant, subevents e' are equivalent distributed shares. Their characterisation is done in various ways. It can be provided mainly by a simple predicate, i.e. intransitive verbs (5a) and passives with suppressed agent (17), or a transitive verb with singular proper noun as subject when the key is the preverbal object (3). From the point of view of distributivity, these cases can be likened to quantifier float examples. Alternatively, it can be done by a transitive verb with its object, like in cases of binominal *each* and distributive numerals, e.g. (8) and (10). In this last case, numerical information from the object is crucial. We come back to this issue when discussing example (35) below.

Differently from Brasoveanu and Henderson, we keep fixed the semantic function of sorting key for the participant, because *quan* does not distribute over events. It is the information on its partition that is encapsulated, and consequently the identification of the subevents θ-related to the cells. $*\theta$(e) in (33) is independently valued and e is the dependent variable in the distributive relation. Encapsulation turns out to have an effect *à double détente*, on the share AND on the key. First, subevents cannot be differentiated other than by the participant whose value comes from a cell of the partition on the key, as illustrated

by (26), and (31). Second, non-differentiation has an impact on the sorting key. When a quantificational structure is introduced by *mei* or other distributive items subject to condition (27), and the distributive share is the nuclear scope, incompatibility with the non-differentiated predication required by *quan* ensues, see (7). Conversely, when no distributive quantifier in the key NP imposes the satisfaction of condition (27), the condition is not triggered. The impossibility for the share/nuclear scope to introduce a differentiation among the elements of the key/restriction, licences the inference of a predication verified for the whole from a predication that is verified distributively and undiscriminatively on the parts. This implements a form of homogeneous inner distribution that we have called wholeness. The value of the whole key, which is the only value directly assigned by the assignment function, does not look partitioned by the predicate. This cumulative inference meshes with the status of dependent variable of e, which is required to be a plurality because the partition on the key is non-trivial.

The use of the partition on the key in (33) makes it possible to distribute over a key which is a singular individual, since the partition can 'split up' an entity. There is a restriction, though. The cells are related to subevents via the θ-role, thus each cell must be suitable for discharging such a role, recall the contrast between (18) and (21). Nothing requires that the cells of the key be anonymous, as supported by the acceptability of (34). The constraint of non visibility applies only to the share.

(34) Mali, Lisi he Wang quan lai-le
Mali, Lisi and Wang all come-ASP
Mali, Lisi and Wang came.

In a distributive interpretation, constant shares are paired with constant key units (Tovena, 2016), whereas no constant size is required in cumulative interpretations. When the key is a sum of atoms, distribution may but need not be done over atoms. Atomicity and size identity of the key units seems a default that cannot be easily overturned when there is a numeral in the share, see (16). However, it appears that the cells of the key no longer have to be atomic or of equal size when the share is a subevent with a participant contributed by a bare noun. Indeed, example (35) has both distributive and cumulative readings. The lack of cardinality on the patient seems to have the effect of making it impossible to define subevents of constant size, and this seems to hamper the equipartition of the key. Thus, Part in (33) can be characterised as an equipartition only by default, not by definition. The mechanism by which non-constant shares block such a default is not clear at the moment. Nevertheless, it is clear that those who might consider *quan* to be a share marker, crucially have to concede that it is different from numeral modifiers like in Tlingit.

(35) Zhe wu ge xuesheng quan mai-le hua.
DEM five Cl student all buy-ASP flower
These five students have all bought a flower/flowers

Definition (33) captures the distributivity effect via a universal quantifier on the key. The non-trivial partition on the key requires e to be a plural event. Pluralisation is directly exploited by Cable (2014), who takes a pair <e,x> of individual and event pluralities to be basic, and claims to distribute within them via cumulation. Distribution is properly handled by the cumulation/sub-division mechanism, when the event plurality is the key. But when the key is an individual plurality, the mechanism does not specify how subevents are distributed over the key, because the plurality of individuals x in the pair <e,x> is necessarily part of the share and corresponds to the participant with constant cardinality that identifies subevents, cf. the constraint '$\langle e,x\rangle=\sigma_{<e',y>}.y<x\wedge|y|=n\wedge e'<e\wedge$Participant$(e',y)$' in his formalisation. This cannot be correct for Chinese though, because (8), (16) and (10) are not ambiguous and are not felicitous in a scenario where e.g. the referent of the subject acts collectively or cumulatively in buying-five-books events. Moreover, we doubt that constant shares in general can be paired with non constant units of the key—be the latter a plurality of individuals or events—and still yield a true distributive dependency (Tovena, 2016).

The universal quantifier in (33) may seem too strong for the treatment of examples with collective predicates such as *he-xie* 'co-write' (Luo Qiong-peng p.c.). However, its function is to use up the sorting key, and no strong reciprocity ensues with symmetric predicates, in the sense of Dalrymple et al. (1998). The domain is exhaustified only for the key under the $\forall\exists$ mechanism, no need to exhaust the domain of co-authors for each author. What is waived by symmetry is the need to check that coauthors vary, hence condition (27) is not met.

5 Summing up

The distributive adverbial *quan* of Chinese is treated as an event predicate modifier that forces a distributive reading on a sentence by targeting a nominal that expresses a plural participant and modifying the θ-role that relates it to the event.

Distribution is only over participants, and it is subject to restrictions coming from the relevant θ-role. Examples where the sorting key is a singular individual, and descriptive generalisations based on extensional domains provide evidence for the distributivity of *quan*.

The incompatibility with adverbs that differentiate subevents, such as *gezi*, points toward a non-differentiation condition that also helps to explain native speakers' intuitions, who consistently describe *quan* as distributing over the members of the key while focussing on the whole key.

Bibliography

Bach, E., E. Jelinek, A. Kratzer, and B. Partee H. (1995). *Quantification in Natural Languages*. Dordrecht: Kluwer.

Brasoveanu, A. and R. Henderson (2009). Varieties of distributivity: *One by One* vs *each*. In *Proceedings of SALT XIX*, pp. 55–72.

Brisson, C. (1998). *Distributivity, maximality and floating quantifiers*. Ph. D. thesis, University of Rutgers.

Cable, S. (2014). Distributive numerals and distance distributivity in Tlingit (and beyond). *Language 90*, 562–606.

Cheng, L. (1995). On dou-quantification. *Journal of East Asian Linguistics 4*, 197–234.

Choe, J.-W. (1987). *Anti-Quantifiers and a Theory of Distributivity*. Ph. D. thesis, University of Massachusetts Amherst.

Dalrymple, M., M. Kanazawa, Y. Kim, S. Mchombo, and S. Peters (1998). Reciprocal expressions and the concept of reciprocity. *Linguistics and Philosophy 21*, 159–210.

Greenberg, Y. (2006). Tolerating exceptions with 'descriptive' and 'in virtue of' generics. In K. von Heusinger and K. Turner (Eds.), *Where Semantics Meets Pragmatics*, pp. 197–222. Amsterdam: Elsevier.

Lee, P.-L. P., H.-H. Pan, and L. Zhang (2013). Chinese adverbial *quan* as a dual-function operator: a domain restrictor and a universal quantifier. *Linguistics and the Human Sciences 8*, 169–204.

Lee, T. H.-t. (1986). *Studies on Quantification in Chinese*. Ph. D. thesis, University UCLA.

Lin, J.-w. (1996). *Polarity Licensing and Wh-phrases Quantification in Chinese*. Ph. D. thesis, University of Massachusetts, Amherst.

Lin, J.-w. (1998). Distributivity in Chinese and its implications. *Natural language semantics 6*, 201–243.

Lü, S.-X. (1980). *800 Major Words in Contemporary Chinese*. Beijing: Shangwu Yinshuguan. (现代汉语800词，北京：商务印书馆)[In Chinese].

Tomioka, S. and Y. Tsai (2005). Domain restrictions for distributive quantification in Mandarin Chinese. *Journal of East Asian Linguistics 14*, 89–120.

Tovena, L. M. (2016). Le type ratio parmi les configurations distributives. *Travaux de linguistique 72*.

Tunstall, S. L. (1998). *The interpretation of quantifiers: semantics and processing*. Ph. D. thesis, University of Massachusetts Amherst.

Yang, T.-H. T. (2013). Distributivity in Mandarin Chinese. *USTWPL 7*, 21–35.

Zhou, R. (2011). The semantic feature 'integrity' of *quan* (全) and its syntactic consequences. *Zhongguo Yuwen* (2). [In Chinese]