Functional Quantification in Distributivity and Events: A View from Chinese

This study attempts to present a novel and unified analysis for the distributivity over individuals (DOI) as well as distributivity over eventualities (DOE) wrt *dou*-quantification in Mandarin Chinese (MC) on the basis of the following assumption (cf. de Swart (1993); von Fintel (1994); Rothstein (1995); Zimmermann (2002); Beaver & Clark (2003), etc.):

(1) Let α be the denotation of NP, ρ be the denotation of the sentence "$NP_{(sing/pl.)}$ dou VP" minus the quantifier, "NP dou VP" has the following truth conditions (simplified somewhat):

$\forall e\,(e \in E \wedge ARG(E,^{(*)}\alpha) \rightarrow \exists e'\,(\rho(e') \wedge M(e,e')))$ *(E: (deictic) topical set; ARG: argument; *: Link Pl. op.)*

(M is a matching function M: $A \rightarrow B$, an injection such that: (i) $\forall x_1, x_2 \in A: x_1 \neq x_2 \Rightarrow M(x_1) \neq M(x_2)$); (ii) $X \subseteq Y$ ($\{x \mid x \in A\} \subseteq \{y \mid \exists x(x \in A) \,\&\, y = M(x)\}$); (iii) $\forall y \in B: \exists x \in A: M(x) \leq y$)

An M function is a monomorphism, and it has the properties like structure-preserving, one-to-one, etc. In the remaining part of this abstract, I will discuss some new semantical observations regarding adverbial quantification in MC to show how this function-based analysis fares better than the existing literature that endorses a first-order distributivity-operator (D-operator) analysis. By providing a unified account for DOI *dou* and DOE *dou*, I will also show how the DOI follows as a by-product of DOE (not that FREE if we don't assume an M), and the co-variation requirement (i.e. the value assigned to the individual variable varies with the value assigned to the situation/event variable which is bound by the adverbial quantifiers) in situation-based quantification theories can be decomposed into the independent properties of the matching function.

***Dou*-quantification over events** Distributivity in natural languages has always been modeled through a distributive quantification, involving the postulation of a distributivity operator, either explicit or implicit, with or without a cover (cf. *inter alia* (cf. Dowty & Brodie (1984); Link (1983, 1991); Schwarzschild (1996); Lasersohn (1998); Brisson (2003)). Regarding Chinese, it has been frequently proposed that MC has an overt realization of that D-operator, namely, *dou* (cf. Lee (1986); Lin (1998); Wu (1999); Yang (2001); Tomioka & Tsai (2005); among others):

(2) $\|Dou\| \Rightarrow \lambda P \lambda X \forall y[y \in X \wedge y \subseteq \|Cov\| \rightarrow P(y)]$, where $P \in D_{<e,t>}$

This D-operator analysis provides straightforward semantics for DOI. The following examples (3)-(4) demonstrate what the basic requirements for the typical DOI cases are: (a) *dou* must occur pre-verbally; (b) the domain of *dou* must be located to the left side of *dou* (within its m-commanding domain); (c) *dou* can only quantify over a plural denotation.

(3) a. *Tongxue-men dou lai (*dou) le*
student-pl. dou come PER Lit.: The students {all/each} came.
a'. $\forall x[x \subseteq \text{students'} \rightarrow \text{come'}(x)]$
b. * *John dou lai le*. (no plural denotation)

(4) a. *Zhe-xie shu wo dou xihuan (*dou)*. (topic)
Dem-pl. book I dou like Lit.: As for these books, I like them all.
a'. $\forall x\,[x \subseteq \iota\text{book'} \rightarrow \text{like'}(x)(I')]$
b. * *Wo dou xihuan zhexieshu*. (no plural denotation within its m-commanding domain)

However, the D-operator analysis has great difficulty in accounting for the DOE case, a fact that has been known for quite a while among some descriptive Chinese linguists albeit hasn't received much proper semantic treatment (cf. Ma (1983); Jiang (1998); Pan (2006); etc.):

(5) *Wo dou mai nizi de yi-fu*.
I dou buy woolen NOM clothes Lit.(approximately): I always buy Woolen clothes.
a. *$\forall x\,[I(x) \rightarrow x$ BUY WOOLEN CLOTHES]
b. $\forall x\,[I\_BUY\ x \,\&\, CLOTHES(x) \rightarrow x = WOOLEN\_CLOTHES]$ (? *dou* = only)

(6) a. *Wo dou shang Google.*
I dou visit Google Lit.(approximately): I always visit Google.
b. $\forall s[s \in$ a set of situations $\rightarrow$ I visit Google in s]

Note that two of the three basic requirements for DOI are violated in (5) and (6), namely, there is no plural subject NP within *Dou*'s m-commanding domain. Here arises the first question: is the DOI *dou* different from the DOE *dou*? To maintain the unified D-operator analysis of *dou*, the only way left is to assume some implicit domain, a line of thinking that is pursued in Jiang (1998) and Pan (2006). Both Jiang and Pan assume that in (5), the focus /topic (presupposition) demarcation provides the quantificational structure for *dou*: the focus is mapped onto the Nucleus and the Topic (the remaining part of the sentence minus the focus) is mapped onto to the Restrictor. (5) then has an interpretation as (5b), where the constituents c-commanded by *dou* is in focus (namely, [VP [mai [nizi de yifu]^{F}]^{F}]). When there is no focus, some other implicit domain is assumed (NB: they don't explicitly assume a covert quantifier restriction strategy, but they are willing to adopt it, as the author understands it), so (6) has an interpretation like (6b).However, there are several non-trivial problems with this analysis that maintains a unified D-operator. First, why in sentences like (6), *dou* is

not sensitive to focus (even though *Google* is in focus, it is still to be interpreted as (6b) instead of the *only*-like (5b)) and an additional implicit domain of situations has to be postulated? Secondly, to model *dou* on *only* ('zhi-(you)') as illustrated in (5) is independently problematic. Unlike *zhi* ('only'), *dou* doesn't impose an exhaustivity requirement (cf. Beaver & Clark (2003) for the difference between *always* and *only*):

(7) a. ?Zhang San dou xihuan [Lin Meimei]^{F}, Zhang San ye dou xihuan [Xue Baochai]^{F}.
Zhang San dou like Lin Meimei Zhang San also dou like Xue Baochai
'Zhang San always likes Lin Meimei, and Zhang San also always likes Xue Baochai.'
b.* Zhang San zhi xihuan [Lin Meimei]^{F}, Zhang San ye zhi xihuan [Xue Baochai]^{F}.
'Zhang San only likes Lin Meimei, and Zhang San also only likes Xue Baochai.'

(8) $\forall$x (person(x) & Zhang San_like(x) $\rightarrow$ x = Lin Meimei) $\wedge$ $\forall$x (person(x) & Zhang San-like(x) $\rightarrow$ x = Xue Baochai)

Pan's semantics of *dou* would give the truth condition (8) for (7a) and (7b) (we can extend *dou* here to events without changing the outcome). (8) means either Zhang San likes nobody or Lin Meimei is Xue Baochai. This (contradictory) semantics correctly rules out (7b). Why (7a) is acceptable is unexpected if *dou* is analyzed as *zhi* albeit in (5) to treat *dou* as *zhi* yields a correct semantics. **Note here even if we extend *dou* to distribute over events without assuming something more, we would face the same problem.** Thirdly, the semantics like (5b) sometimes might have some undesirable consequences regarding polarity items licensing. According to Pan, we could have (9a') (which has an NPI in its restrictor) as the semantics for (9a), which would be expected, wrongly, to be acceptable, in contrast with (9b) (*conglai* $\approx$ 'ever'):

(9) a. * Wo dou [conglai [mai nizi de [yifu]^{F}]^{F}]. b. Wo conglai dou mai nizi de yifu.
I dou ever buy wollen NOM clothes
a'. $\forall$x, e [I_ever $_{NPI}$_BUY (x, e) & CLOTHES(x, e) $\rightarrow$ x = WOOLEN_CLOTHES (e)]

Last but not least, what is crucial here is the DOE sentences of *dou* allow a family of interpretations, and a single D-operator analysis is just **inadequate** because it may need to assume many implicit domains for *dou*, say, individuals, set of situations, etc. and the relevant syntactic argument is lacking. The encouraging fact is that although 'NP *dou* VP' can be true under a family of situations, its range of semantics is not that unpredictable. Is that a **general** albeit **restrictive** semantics for *dou* that is able to account for this problem?

The proposal The study attempts to answer the above problems. I propose: (i) *Dou* has some portmanteau semantic structure: it is a universal quantifier but it also introduces a matching function (an injective function M as defined in (1)) that takes members of the quantifier's restrictions and matches them with an existentially introduced variable in the Nuclear Scope of the quantifier; (ii) *dou* uniformly quantifies over eventualities ('event' is adopted here neutrally), and a DistKey and DistShare is assumed for *dou*'s quantificational structure: the DistKey forms the domain of quantification for the universal quantifier as long as it has the topical status (either due to structural OR contextual factors) and the DistShare forms the Nuclear Scope; (iii) the matching function is a contextually-restricted variable over (injective) functions. Apart from retaining all the advantages of the D-operator analysis of *dou*, this proposal has its own advantages. Firstly, it readily captures the fact that DOE sentences allow rich interpretations without losing the descriptive power, as the context that could be identified as the topical set for *dou* is rich, and M can be contextually accommodated (in this case, (5b) and (6b) are rendered as some special instantiations of this more general semantic machinery); Second, it avoids the problem that equals *dou* with *only*, and the explanation for the contrast between (7a) and (7b) is ready:

(10) $\forall$e ((E_c(e) $\wedge$ ARG(E_c, Zhang San))$\rightarrow$ $\exists$e' (Zhang San_like_Lin Meimei (e') $\wedge$ M(e,e'))) $\wedge\forall$e ((E_c(e) ARG(E_c, Zhang San))$\rightarrow$ $\exists$e' (Zhang San_like_Xue Baochai (e') $\wedge$ M(e,e')))

If we assign different values for M, (10) isn't contradictory. (7a) is predicted to be acceptable, correct!

A unified account for DOI and DOE *dou* A unified account for DOI *dou* and DOE *dou* is in order. Take (3) ('the students *dou* came') as an example. In DOI sense, (3) is true iff the denotation of 'students' is a subset of 'comers'. In DOE sense, (3) is true iff for all events involving students (a plural operator * a la Link is needed) as the ARG (or any other theta-role), each of these events is **embedded** to an event of 'the coming of the students'. The injective function guarantees the embedding relation between the two sets. Note the semantics here is still one-to-one. It is possible for 'Every student bought a book' to mean some students bought the same book (accidentally), but the 'buying book' events are distinct, co-varying with the value assigned to the argument in each event. Let M be the embedding function, we have:

(11) $\forall$e ((E_c(e) $\wedge$ ARG(E_c, *student))$\rightarrow$ $\exists$e' (e$\leq$e'$\wedge$ students_come (e'))) =(3) (*students = {a, b, a$\oplus$b, …}

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