Quantifier scope ambiguity in Mandarin dative constructions

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Introduction. Although Mandarin has been widely considered a "rigid-scope language" since Huang (1982), some studies (e.g., Larson & Wu, 2018; Lin, 2013; Su, 2001) have argued that quantifier scope ambiguity (QSA) can be observed in a variety of constructions other than simple transitive sentences, such as dative constructions (DCs). For example, (1) is ambiguous in allowing both surface scope (SS; $\exists > \forall$) and inverse scope (IS; $\forall > \exists$) interpretations. The IS interpretation (1b) is attributed to quantifier raising (QR) by these studies.

(1) Zhangsan mai-le   **yi-kuai** dangao gei **mei-yi-wei**   nvsheng.
      Zhangsan buy-ASP one-CL cake   give every-one-CL girl
      'Zhangsan bought a cake for every girl.'
      a. $\exists > \forall$ (SS): 'There was one cake that Zhangsan bought for every girl.'
      b. $\forall > \exists$ (IS): 'For every girl x, Zhangsan bought a (potentially different) cake for x.'

However, QR fails to explain why (2), where the $\forall$-QP precedes the $\exists$-QP in the otherwise identical DC to (1), is *not* ambiguous. The crucial observation is that (2) only permits the *IS* reading ($\exists > \forall$) even though in syntax the direct object should be able to c-command the indirect object (Lin & Huang, 2015). Meanwhile, many speakers seem to prefer the IS over the SS reading for (1), which is at odds with Anderson's (2004) Processing Scope Economy. In this paper, we offer an analysis based on the above judgments which are experimentally supported.

(2) Zhangsan mai-le   **mei-yi-kuai**   dangao gei **yi-ge**   nvsheng.
      Zhangsan buy-ASP every-one-CL cake   give one-CL girl
      'Zhangsan bought every cake for a girl.'
      a. *$\forall > \exists$ (*SS): 'For every cake x, Zhangsan bought x for a (potentially different) girl.'
      b. $\exists > \forall$ (IS): 'There was one girl for whom Zhangsan bought every cake.'

Proposal: Movement in Mandarin DCs. We follow Lin & Huang (2015) in assuming *gei* (both post-object and preverbal) is a ditransitive verb, but we depart from their analysis in taking (3a) as the underlying structure of (1). In particular, the direct object 'one cake' is base-generated in a position following the indirect object and undergoes *overt movement* to the surface position between *mai-le* and *gei*. The scope interpretation of (1) based on (3a) is (3b).

(3) a. [Zhangsan [mai-le **yi-kuai** dangao [gei **mei-yi-wei** nvsheng yi-kuai dangao]]]
                                                                                            (overt movement)
      b. $\forall x[\text{girl}(x) \rightarrow \exists y[\text{cake}(y) \wedge \text{buy-give}(zs, y, x)]]$
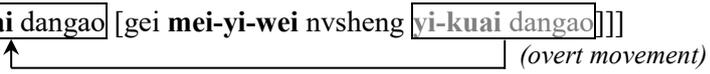
In our analysis, the so-called *IS* reading in (1b) is actually the *SS* reading following the underlying syntax in (3a). Since the $\forall$-QP c-commands the $\exists$-QP, the $\forall > \exists$ scope reading is expected. Moreover, the SS reading in (1a) (the $\exists > \forall$ scope reading) can be derived as a special case where (3b) is also true: If one girl received every cake from ZS, it is necessarily true that for every cake there was one girl who received a cake, albeit the same one. We argue that the movement of 'one cake' is a PF phenomenon, which has no semantic effect such as QR, and that the perceived QSA is due not to QR but to the underlying structure in (3).

Similarly, (2) has the underlying structure in (4a) and the scope interpretation in (4b). This correctly predicts that (2) is *not* ambiguous and only permits the $\exists > \forall$ reading, which is the SS reading in our present account, not "IS", because in (4a) the $\forall$-QP is c-commanded by the $\exists$-QP in the base-generated form. Moreover, since (4b) is incompatible with a scenario where the cakes were given to different girls, the absence of the scope reading in (2a) follows.

(4) a. [Zhangsan [mai-le **mei-yi-kuai** dangao [gei **yi-ge** nvsheng mei-yi-kuai dangao]]]
                                                                                            (overt movement)
      b. $\exists x[\text{girl}(x) \& \forall y[\text{cake}(y) \rightarrow \text{buy-give}(zs, y, x)]]$
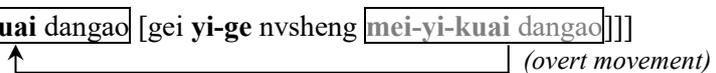
In short, the scope interpretations of (1) and (2) are governed by their underlying structures. Under our analysis, the underlying structures of (1) and (2) are essentially on a par with the *surface* structures of (5) and (6) below, respectively. Our judgment is that (5) is scopally ambiguous whereas (6) clearly lacks the IS reading. Based on the scope interpretations, we argue that the syntax of (1) is derivationally related to the syntax of (5), and (2) to (6), and crucially we can only achieve such parallel with the underlying forms suggested in (3) and (4).

(5) [Zhangsan [gei **mei-yi-wei** nvsheng [mai-le **yi-kuai** dangao]]]
  Zhangsan give every-one-CL girl buy-ASP one-CL cake
  a. ∃ > ∀ (IS): 'There was one cake that Zhangsan bought for every girl.'
  b. ∀ > ∃ (SS): 'For every girl x, Zhangsan bought a (potentially different) cake for x.'

(6) [Zhangsan [gei **yi-ge** nvsheng [mai-le **mei-yi-kuai** dangao]]]
  Zhangsan give one-CL girl buy-ASP every-one-CL cake
  a. *∀ > ∃ (IS): 'For every cake x, Zhangsan bought x for a (potentially different) girl.'
  b. ∃ > ∀ (SS): 'There was one girl for whom Zhangsan bought every cake.'

Experimental evidence. To investigate native speakers' interpretations of doubly quantified DCs and to find out if the proposed underlying structures have an effect on predicting speakers' interpretations, we conducted a pilot experiment that involved 12 doubly quantified dative sentences, along with 24 filler sentences. There were two independent variables (2×2): linear order of quantifiers (*yi* first vs. *mei* first), and ordering of the two QPs in the underlying structure (∃ > ∀ vs. ∀ > ∃). Four types of DCs were tested: V-[*yi*-QP]-*gei*-[*mei*-QP] as in (1), V-[*mei*-QP]-*gei*-[*yi*-QP] as in (2), *gei*-[*mei*-QP]-V-[*yi*-QP] as in (5), and *gei*-[*yi*-QP]-V-[*mei*-QP] as in (6). Each sentence was followed by a potentially collective (∃ > ∀) and a potentially distributive (∀ > ∃) paraphrase. For each test sentence, 8 Mandarin native speakers were tasked to judge which paraphrase matches the sentence best.

Table 1 summarizes participants' responses in each condition. An ordinal regression model showed that *Underlying Structure* had a main effect on interpreting doubly quantified DCs ($\beta = -4.91$, $SE = 0.81$, $z = -5.15$, $p < .001$). Sentences with an underlying structure of "∀ > ∃", such as (1) and (5), were considered ambiguous more often than sentences with an underlying structure of "∃ > ∀" (51.56% vs. 9.38%). In fact, most participants agreed that sentences with the underlying structure "∃ > ∀" such as (2) and (6) only had the collective reading, regardless of the linear order of quantifiers. The preference for the distributive reading of "*gei*-[*mei*-QP]-V-[*yi*-QP]" sentences can be explained by the effect of *Linear Order*. Overall, the experimental results provide empirical support for our analysis along the lines of (3) and (4).

Table 1	*Underlying Structure*	∀-QP > ∃-QP		∃-QP > ∀-QP	
	Linear Order	*yi* first	*mei* first	*mei* first	*yi* first
	Sentence	V-[*yi*-QP]-*gei*-[*mei*-QP]	*gei*-[*mei*-QP]-V-[*yi*-QP]	V-[*mei*-QP]-*gei*-[*yi*-QP]	*gei*-[*yi*-QP]-V-[*mei*-QP]
	collective	8	1	13	16
	ambiguous	17	16	3	0
	distributive	7	15	0	0
	total	32	32	16	16

Summary. We have argued that the QSA observed for DCs like (1) is due not to inverse scope or QR, but rather to (i) an underlying syntax that is different from the surface form and (ii) an overt movement of a QP from the lowest position to one following the main verb. This account correctly predicts the perceived QSA of (1) and the lack of QSA of (2), the judgments of which are experimentally supported. The predictions are correctly made without resorting to QR, and thus this analysis aligns well with Huang (1982) that Mandarin is a "rigid-scope language."

Selected references: **Larson**, R., & **Wu**, H. (2018). Quantifier scope and topicality in Mandarin. IACL-26. **Lin**, T.-H. J. (2013). QR and finiteness. In *Deep insights, broad perspectives: Essays in honor of Mamoru Saito*. **Lin**, T.-H. J., & **Huang**, Y.-S. (2015). Structures of the Mandarin *gei* constructions. *Journal of East Asian Linguistics*. **Su**, Y.-C. (2001). *Scope and specificity in child language*. Doctoral dissertation, University of Maryland.