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Some Preliminary Notes on the Scope of Numeral Phrases and Restructuring Contexts

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The limited goal here is to lay out an empirical puzzle having to do with scope of numeral phrases and suggest possible directions to proceed towards its resolution.¹⁾ It has been noted since Longobardi (1987) that 'how many' phrases display scope reconstruction effects. (See Szabolcsi and den Dikken 2003 for a comprehensive review.) The English example in (1) is ambiguous between the interpretations given in (2) a and (2) b.

- (1) How many students does Scott incorrectly believe Tomo got angry at?
- (2) a. For what number n: Scott incorrectly believes that Tomo got angry at n-many students.

(amount reading: incorrectly believe >> n-many students)

b. For what number n: there are n-many students x_i such that Scott incorrectly believes that Tomo got angry at x_i. (individual reading:n-many students >> incorrectly believe)

The a-reading, dubbed the "amount reading", has the interpretation in which the numeral phrase scopes *below* the matrix attitude verb *incorrectly believe*. For the b-reading, dubbed the "individual reading", the numeral phrase scopes *above* the matrix verb. Since (1) is a matrix wh-interrogative, these two different readings are associated with different true answers. So let's consider the true answer(s) to (1) under the scenario that follows: Tomo got angry at two students, S1 and S2, in a meeting. Lydia was there whereas Scott wasn't. Lydia told Scott, "Tomo got angry at some people during the meeting. I wrote down who he got angry at." The next day, Scott found a piece of paper on Lydia's desk and saw the names of ten students, S1, S2, S3, S4, S5, S6,

S7, S8, S9 and S10. Scott mistakenly believed that Tomo got angry at each of those students.

Given this scenario, one may give the answer "Ten" to the question in (1). This is a true answer because Scott in fact has the (wrong) belief that Tomo got angry at 10 students. The wh-question instantiated as in (1) is asking the number of students such that Scott incorrectly believes that Tomo got angry at that number of students. This is what we call the amount reading whose interpretation is represented as in (2) a. In addition, the question can be answered by "Eight" also, even though this answer is a little harder to obtain than the amount reading. When answered this way, the question is interpreted to be asking how many students are the students such that Scott has a wrong belief about them ((2)b). In the current scenario, S1 and S2 are *correctly* believed by Scott to have angered Tomo, whereas S3, S4, S5, S6, S7, S8, S9 and S10 are *incorrectly believed* by him to have the property in question. What matters in the individual reading is therefore which individual Scott misidentified and how many such students there are.

The same observation can be made in Japanese.²⁾ Consider the following:

(3) [nan-nin-no gakusei]-ni_i Scott-wa [Tomo-ga t_i how many students-DAT S.-TOP T.-NOM okotta-to] kantigaisiteiru-nodesu-ka got.angry-COMP incorrectly.believe-NODA-Q
'Q How many students, Scott incorrectly believes that Tomo got angry at t?'

This wh-question displays ambiguity of the sort that we have seen for (1) from English. It is worth noting that this sort of ambiguity obtains not only with wh-questions. Rather, the behavior of 'how many' phrases at issue comes from a property of overt movement and the scopal nature of numeral phrases, although they interact with wh-scope marking, as noted by Nishigauchi (2002: 90). Two facts suggest that this view is plausible. First, no such ambiguity obtains when the 'how many'

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phrase stays in situ in Japanese:

- (4) Scott-wa [Tomo-ga [nan-nin-no gakusei]-ni
 S.-TOP T.-NOM how many students-DAT okotta-to] kantigaisiteiru-nodesu-ka
 got. angry-COMP incorrectly. believe-NODA-Q
 'Q Scott incorrectly believes that Tomo got angry at how many students?'
 - a. For what number n: Scott incorrectly believes that Tomo got angry at n-many students.

Amount reading: incorrectly believe >> n-many students)

b. *For what number n: there are n-many students x_i such that Scott incorrectly believes that Tomo got angry at x_i. (individual reading:n-many students >> incorrectly believe)

This question, unlike the one we saw in (3), cannot be taken to be asking the number of the students who are incorrectly believed by Scott to have angered Tomo. In other words, the question cannot be answered by "Eight" under our 'student meeting' scenario. When the 'how many' phrase stays put, the individual reading disappears and only the amount reading is available. So even if the numeral phrase is a wh-phrase, ambiguity doesn't arise unless there is overt movement. Another argument that scope ambiguity is not due to wh-questions per se is that ambiguity obtains even if the numeral phrase is not a wh-interrogative, as long as it moves across the attitude verb.

- (5) [hati-nin-no gakusei]-nii Scott-ga [Tomo-ga ti eight student-DAT S.-NOM T.-NOM okotta-to] kantigaisiteiru got. angry-COMP incorrectly. believe
 '[Eight students], Scott incorrectly believes that Tomo got angry at t'
- (6) a. For number n=8: Scott incorrectly believes that Tomo got angry at n-many students.

(amount reading: incorrectly believe >> eight students)

 b. For number n=8: there are n-many students x_i such that Scott incorrectly believes that Tomo got angry at x_i. (individual reading: eight students >> incorrectly believe)

This sentence is ambiguous. Our 'student meeting' scenario makes the amount reading ((6)a) and the individual reading ((6)b) false and true, respectively. On the other hand, when the numeral phrase stays put as in (7), the individual reading ((6)b) is clearly unavailable. Only the amount reading ((6)a) is available and it turns out to be false in our scenario. Consequently, (7) cannot be true in any way under our scenario.

(7) Scott-wa [Tomo-ga [hati-nin-no gakusei]-ni
S.-TOP T.-NOM eight student-DAT okotta-to] kantigaisiteiru
got. angry-COMP incorrectly.believe
'Scott incorrectly believes that Tomo got angry at eight students'

It thus seems empirically correct to say that overt movement, whether it involves wh-interrogation or not, plays a crucial role. This is summarized as in (8):

(8)		AMOUNT READING	INDIVIDUAL READING
	English	√ (1)a	√ (1)b
1	Japanese (scrambled)	√ (3)a/(5)a	\checkmark (3) b/(5) b
• • *	Japanese (in situ)	$\sqrt{(4)a/(7)a}$	* (4) b/ (7) b

Assuming a copy theory of movement and a standard theory of scope based on c-command, the wide scope reading is only available when there is a copy of the numeral phrase c-commanding the attitude verb at LF. This copy obtains by overt movement to the matrix clause, whether it's wh-movement or scrambling. (We will return to the question as to why covert movement doesn't yield the individual reading.) In passing, I would like to note further evidence that the Japanese phenomenon can be treated in essentially the same way as the phenomenon identified as scope ambiguities in 'how many' questions in English. In his (1991) review of Rizzi's *Relativized Minimality*, Frampton observed, based on Heim's discussion of *there* constructions, that when a fronted 'how many' phrase originates in the post-copular position of *there*-existential, scope reconstruction is forced. Consider the pair in (9) (from Rullmann 1995: 195) and the two relevant interpretations given in (10):

- (9) a. How many police officers did they claim there were t at the scene of the crime? (*individual reading/ ✓ amount reading)
 - b. How many police officers did they claim t were at the scene of the crime? (\checkmark individual reading/ \checkmark amount reading)
- (10) a. For what number n: they claimed that there were n-many police officers at the scene of the crime. (amount reading)
 - b. For what number n: there are n-many police officers x_i such that they claimed that x_i was at the scene of the crime. (individual reading)

The post-copular position of *there* constructions, unlike regular subject position, resists having a variable of type $\langle e \rangle$ (the definiteness effect). Japanese doesn't seem to have expletives of the *there* type, but we can find a context where the definiteness effect shows up. According to Kishimoto (1996, 2000) and Muromatsu (1996), the possessive construction with dative subject displays a definiteness effect, as in (11).

(11)	а.	Taroo-ni	kodomo-ga	iru
		TDAT	child-NOM	exist(PRES)
		'Taro has a	child/children	,
	b.	*Taroo-ni	Hanako-ga	iru
		TDAT	H-NOM	exist (PRES)

(Lit.) 'Hanako exists to Taro.'

The contrast between (11) a and (11) b shows that names cannot occur in the complement position of the existential verb *iru* 'exisit'. Also, as Kishimoto notes, relative clauses made out of the possessive construction, such as **Taroo-ni iru kodomo* "kid(s) who Taro has *e*" don't work because we cannot create the predicate [λ x. Taro-ni x-ga iru], where a variable of type <e> appears in the complement position of *iru*. Keeping this in mind, let's take a look at (12), where the possessive construction is embedded under *kantigaisuru* 'incorrectly believe' and a numeral phrase, being scrambled, originates in the complement of iru.³

(12) ?? [san-nin-no kodomo]-gai Masaya-wa [Hanako-ni ti three. children-NOM M.-TOP H.-DAT
iru-to] kantigaisiteiru
be-COMP incorrectly. believe
'Three children, Masaya incorrectly believes Hanako has t' (*individual reading/ amount reading)

The sentence cannot mean that there are three kids such that Masaya has the wrong belief that they are kids of Hanako's. Rather, it only means, if it is acceptable at all, that Masaya has the wrong belief that Hanako has three kids.⁴⁾ Scrambling, like English wh-movement, doesn't change the scope of a numeral phrase when the predicate downstairs induces the definiteness effect. There is yet another similarity between scrambling and wh-movement. (13) illustrates the wellknown fact that reconstruction is impossible when the reconstruction site is inside an island.

(13) How many books did John wonder [whether to read t this week]? (individual reading/ *amount reading)

This sort of 'weak island' effect obtains in Japanese in such a way that a 'how many' phrase cannot appear anywhere inside a weak island in surface structure. In (14), a 'how many' phrase stays inside an island

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created by *kadooka* 'whether'. The sentence is totally out ((15)a and (15)b illustrate the two interpretations that the sentence would have):

- (14) *Lydia-wa [Tomo-ga [nan-nin-no gakusei]-ni L.-TOP T.-NOM how many students-DAT okotta-kadooka] siritagatteiru-no got. angry-whether want. to. know-Q
 'Q Lydia is wondering whether Tomo got angry at how many students?'
- (15) a. For what number n: Lydia is wondering whether Tomo got angry at n-many students. (amount reading)
 - b. For what number n: there are n-many students x_i such that Lydia is wondering whether Tomo got angry at x_i. (individual reading)

Although I cannot commit myself here to any issue bearing on theories of weak islands, the unacceptability of (14) can be understood in the following way: We take the weak island effect to be the generalization that no copy of the form [t_{wh} -CL-Gen NP], such as [t_{wh} -nin-no gakusei] or [t_{wh} many students], is allowed inside the island (See Cresti 1995 and Rullmann 1995 on this matter. See also Szabolcsi and Dikken 2003). In (14), *nan-nin-no gakusei* 'how many students' stays in-situ, hence a weak island effect. On the other hand, overt scrambling of the 'how many' phrase out of the island should be able to circumvent the weak island effect, if the generalization is correct. Given that the wh-numeral phrase cannot leave a complex copy (e.g. [DP t_{wh} -many students]) downstairs due to the island effect, we expect that only the individual reading (given in (15)b) is available. This is exactly what happens, as in (16) below.

(16) ? [nan-nin-no gakusei]-nii Lydia-wa [Tomo-ga ti how many students-DAT L.-TOP T.-NOM okotta-kadooka] siritagatteiru-no got. angry-whether want. to. know-Q
'Q how many students, Lydia is wondering whether Tomo

got angry at t?'

This sentence sounds a bit marginal, but I find a sharp contrast between this and the entirely unacceptable sentence (14). As is expected, (16) only has the individual reading. This interrogative sentence is only able to ask the number of the people such that Lydia wants to know whether Tomo got angry at those people.

Having seen that numeral phrases and matrix propositional attitude verbs interact scopally when the former are scrambled out of the embedded clause, we turn to cases where ambiguity seems to arise without overt movement. That is, there are cases where embedded numeral phrases may take wide scope with respect to the matrix verb even when they are not scrambled. Sentences like (17) seem to be ambiguous to many speakers, as is noted by Nishigauchi (2002: 62), who observes scope ambiguity in a control construction with the morphologically complex V-*tagaru* 'want to V'. Similarly, *suru* 'do' in (17), like English *try*, is an obligatory control verb when it takes the complement headed by the complementizer (*y*) *ooto*. (Ambiguity therefore obtains even when the embedded V is not morphologically fused with the matrix verb.)

- (17) kimi_i-wa [e_i Taroo-ni nan-nin-no hito-o you-TOP T.-DAT how many people-ACC syookaisi-yooto] siteiru-no introduce-COMP is. doing-Q
 'Q are you trying to introduce how many people to Taro?'
 - a. What is number n: you are trying to introduce n-many people to Taro (e. g. at today's party). (amount reading:
 try >> n-many people)
 - b. What is number n: there were n-many people x_i that you are trying to introduce x_i to Taro. (individual reading: n-many people >> try)

Assuming that the ambiguity of (17) is real, note that this is not expected from the generalization we have seen, because the numeral phrase hasn't undergone overt movement.⁵⁾ Why is it the case that the b-reading is available despite that the 'how many' phrase stays in situ, whereas in the examples we have seen so far, numeral phrases, being in-situ, are not able to take wide scope?

I would like to suggest two directions that we can take to solve this problem. Either approach may involve 'restructuring'. One approach is to use Hornstein's (1994) generalization that covert phrasal movement of the sort involving ACD obeys the 'Boundedness Restriction' (BR), which prevents QPs from raising across a clause-boundary (see Baltin 1987, Larson and May 1990). As is shown below (Hornstein's (7)), the elided VP in (18) a is not allowed to mean "think that Fred read x".

- (18) a. Who thought that Fred read how many of the books that Bill did?
 - b. Who thought that Fred read how many of the books that Bill { \checkmark read t/ *thought that he read t}?

This suggests that the lower wh-phrase cannot be adjoined to the matrix TP or VP by covert movement. However, as Hornstein observes, so-called 'restructuring' verbs loosen the BR. The ambiguity of (19)a (Hornstein's (23)) tells us that when a certain class of control predicate is used, ACD applies as if the clausal boundary didn't exist. The availability of the reading in which the empty VP means "want to visit x" indicates that this is the case, namely that QR can raise the wh-phrase to the matrix clause as well.

- (19) a. Which student wants to visit which city that you do?
 - b. Which student wants to visit which city that you {visit *t*/ want to visit *t*}?

The combination of the BR and the 'restructuring' effect helps resolve the puzzle that we have seen for Japanese. Since (*yooto*) *suru* 'try' in (17) is clearly an instance of obligatory control verb (Sakaguchi 1990, Watanabe 1996), it is not unreasonable to think that restructuring applies to the embedded clause headed by *yooto* and that the process circumvents the BR effect.⁶⁾ Thus the 'how many' phrase can undergo 'long' covert phrasal movement and becomes able to scope above *yooto-suru*, as illustrated by the representation in (20) (for (17)) (The 'how many' phrase may be adjoined to the matrix VP site, which doesn't really matter to us.)⁷⁾

(20)	[[_{TP} [nan-n i	n-no hito-o]j	[TP kimi _i -wa [CP	e_{i}
	how ma	ny people-ACC	you-TOP	
	Taroo-ni t_j	syookaisi-yooto]	<pre>siteiru]]-no]</pre>	
	TDAT	introduce-COMP	is.doing-Q	

The other approach has to do with overt but 'string-vacuous' scrambling.⁸⁾ Suppose that we analyze (17) in such a way that scrambling of the indirect object and that of the direct object yield the following 'surface-structure' representation (where the embedded clause is highlighted):

(21) [[kimii-wa [Taroo-ni]j [nan-nin-no hito-o]k [cP e, tj tk you-TOP T.-DAT how many people-ACC syookaisi-yooto] siteiru]-no] introduce-COMP is.doing-Q

Here the 'how many' phrase c-commands the matrix verb, which seems to be enough for us to have the former take scope over the latter at LF. If we put forward this approach, one necessary task is to explain why (4), repeated below, fails to have the wide scope (or individual) reading.

(22) Scott-wa [Tomo-ga [nan-nin-no gakusei]-ni
 S.-TOP T.-NOM how many students-DAT okotta-to] kantigaisiteiru-nodesu-ka
 got. angry. at-COMP incorrectly.believe-NODA-Q

To get the right result for (22), we have to say that the LF for it is not allowed to have an analysis of the kind presented in (23). The subject and the object are scrambled string-vacuously in this analysis.

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(23)	Scott-wa Tomo-gai [nan-nin-no gakusei]-nij		
	STOP	TNOM	how. many. students-DAT
	[cp ti tj	okotta-to]	kantigaisiteru-nodesu-ka
		got. angry. at	-COMP incorrectly.believe-NODA-Q

Here the 'how many' phrase c-commands the matrix verb, which leads to the incorrect prediction that the former can scope above the latter. So (23) should be excluded somehow. We can use for the present purposes the ban on subject scrambling (Saito 1985) and/or the ban on long distance VP adjunction (Saito 1994). Suppose now that subjects can be scrambled generally, unlike Saito's claim (cf. Ko 2003) and that we rule out (23) by appealing to the ban on long VP scrambling. Note that this implies that, in the analysis of (17) in (21), we have to say that the object NP is scrambled *short* distance because we are relying on the impossibility of *long* VP-adjunction to rule out (23). One way to achieve the desired result would be to say that the *yooto* clause in (21) undergoes 'restructuring' and that the scrambling out of it counts as short scrambling along the lines proposed by Mahajan (1990) and Nemoto (1993).

In conclusion, this paper has examined a scope puzzle posed by numeral phrases in Japanese and suggested two approaches to it. I leave for future research the task to find argument(s) in favor of one or the other alternative.

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- 1) I focus on numeral phrases of the form 'Numeral-Classifier-Gen NP', such as *san-nin-no gakusei* 'three students'. See Nakanishi (2003) for other types of numeral phrases.
- 2) The observations summarized in (8) below are already noted in Nishigauchi (2002).
- 3) See, though, Tsujioka (2001) for the different judgment.

- 4) When the numeral is not scrambled, it doesn't take wide scope, as is expected.
- 5) I am assuming with Hoji (1985) that DAT-ACC is the base order and that string-vacuous scrambling is not allowed. But see note 8.
- 6) I won't investigate the nature of restructuring any further here. See Wurmbrand (2002) and references therein.
- 7) See Tada (1993) and Bošković and Takahashi (1998) for a scope fact with long scrambling that apparently contradicts the data discussed here and in Nishigauchi (2002).
- 8) String-vacuous scrambling (SVS) here means that the two operations yield the same word order as the order that we would have without scrambling. Hoji (1985) claims that SVS is generally barred. The proposal here however can be reconciled with Hoji's argument against SVS, if we adopt Fox's (2000) Output Economy (see especially Fox 2000: Chapter 2.6). See also Fujii (2004) for further arguments in favor of banning SVS.

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