A Postnominal Preference in Japanese Numeral Classifier Phrases

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1 Introduction

Numerals in Japanese appear with a classifier when quantitizing a noun, as in other classifier languages common in Asia. Despite a general prenominal pattern for other noun modifiers in the language, this article reports on a postnominal preference in Japanese numeral classifier phrases, found in the performance data of two substantial corpora. An explanation is offered with reference to two efficiency principles from the performance theory of Hawkins (2014). The postnominal numeral classifier is proposed to enhance sentence processing without challenging the status of the head in the head-final Japanese. There is therefore a processing motivation for the anomalous postnominal placement of the classifier.

Word order variation of the constituents in a noun phrase often does not seem to follow or correspond to the apparent headedness of the language. There is a general non-correlation between numeral–noun order and head direction (Dryer, 1992), but little is said of the role that numeral classifiers plays in the matter. The postnominal order for the numeral is considerably widespread in the major classifier languages in Asia. In languages that permit both the prenominal and postnominal orders (as in SVO languages like Vietnamese and Chinese, and SOV languages like Japanese and Korean), the

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postnominal order is often assumed as an alternative in certain situations to the possibly more common prenominal order. But this may be an assumption that we want to rethink while addressing word order variations in one of these classifier language, or across the languages.

This article reports on two studies of Japanese performance data, which find a postnominal preference in the numeral classifier phrase. Japanese is a numeral-classifier language where the use of classifiers is obligatory in most expressions of quantity. The numeral and the classifier occur together as a single uninterrupted sequence, as is common in other languages (Greenberg, 1975). There are different views on the construction types to be identified, with the number ranging from five to nine (Martin, 1988; Kim, 1995; Downing, 1996; Amazaki, 2006). (1) shows the five commonly identified constructions, adopting the refined classification in Kim (1995). The unmarked case is widely taken to be when the numeral classifier phrase appears in a prenominal position, with an *attributive* property given by the addition of adnominal *no* 'GEN' suffixed to the numeral classifier phrase (1a). Cases such as (1e) have also been studied under the terminology of adverbialization (Martin, 1988) or (quantifier) floating (Downing, 1996; Amazaki, 2006). Kim (1995) is conservative in naming this position only "locally" external, but the adverbial nature of the numeral classifier phrase is widely accepted in the literature (Fukushima, 1991; Gunji and Hasida, 1999). A case marker is included in the examples to indicate the boundary of the noun phrase.

(1) a. *Prenominal, attributive, NP-internal*
niman ken no tenpo de
twenty.thousand CLF GEN store INS
'by twenty thousand stores'

b. *Prenominal, non-attributive, NP-internal*
guntai ik ko syootai ga
army one CLF platoon NOM
'a platoon of the army'

c. *Postnominal, attributive, NP-internal*
hooseki no hito-tu o hazusi
jewel GEN one-CLF ACC remove
'remove one jewel'

d. *Postnominal, non-attributive, NP-internal*
sobaten yonzyuugo tenpo o
soba.restaurant forty.five store ACC
'forty five soba restaurants'

e. *Postnominal, (locally) external*

nakama ga go nin atumari
fellow NOM five CLF gather
'five fellows gather'

The construction types differ not only by constituent orders but also by formal structures such as the introduction of a genitive marker in the attributive constructions, as in (1a) and (1c), analogous to the structural change between the *s*-genitive and *of*-genitive constructions in English, which also display two distinct constituent orders between the possessor and possessum. Whereas English quantifier constructions in the structure of [(Det) N of (Det) N], such as *two pounds of coffee*, are considered to be a subtype of genitive constructions (Lehrer, 1986), the prenominal attributive construction in Japanese does not suggest such an analysis. Adnominal *no* helps to bind a wide range of associations in the noun phrase.

The choice of classifier is determined partially by the semantics, and it serves to specify the measured unit or boundedness of the lexical item, whether the quantity is expressed by means of a specific numeral or by less specific quantitative expressions such as 'several' (Dixon, 1982; Downing, 1996). The classifiers fill an obligatory slot in the numeral–noun construction often with redundancy of information (Croft, 2001). When placed in the adverbial position, the numeral classifier enters a measuring relation with the verb, while maintaining to be a compatible match with the noun (Levy and Oshima, 2003).

2 The Construction Types

The classifier in Japanese is bound to the numeral that precedes it, more than to the noun. Many studies (e.g. Kim, 1995; Amazaki, 2006) prefer to treat the two constituents as a single syntactic unit, as formalised in (2). The compound behaves similarly to a quantifier, hence the shorthand Q in the rest of this article. The phonological assimilation between the numeral and the classifier in Japanese also supports the analysis, as a phenomenon that only takes place in lexical compounds. For example, *iti* 'one' and *hon* 'long slender object' combine to form *ip-pon* 'one-CLF'.

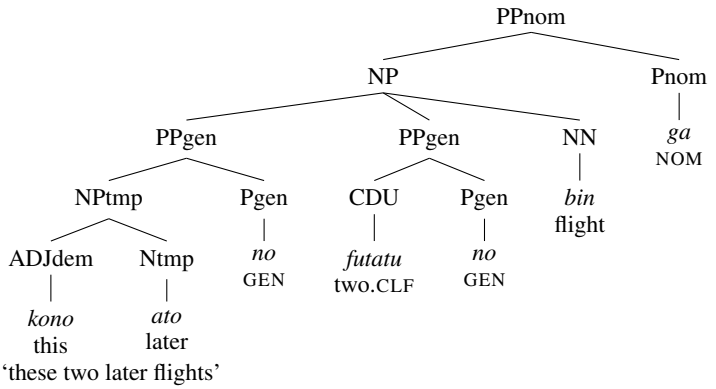
(2) [Numeral Classifier]$_{Q}$

In some other classifier languages, for example in the numeral classifier literature of Mandarin (e.g. Li, 1999), the classifier is considered to be bound to the noun. The different assumptions may lead to significant consequences. Explicit argumentation is not always given but the assumptions made are fairly consistent in the literature within a single language.

2.1 The Prenominal Constructions

The NP-internal prenominal constructions are taken as the unmarked case given the left-branching structure for the head-final Japanese. The high productivity of adnominalization in Japanese allows the noun phrase to create branches on the left indefinitely. Example (3) illustrates the left-branching structure given by a Head-driven Phrase Structure Grammar analysis, taken from the Tübingen treebank for spoken Japanese (Hinrichs et al., 2000).[1]

(3)



'these two later flights'

Amazaki's (2006) draws our attention to the sensitivity of processing efficiency regarding the preference of constituents orders in the prenominal constructions. There is a general preference for adjective-like modifiers to appear closer to the noun than the numeral (4a). But when the accompanying modifiers are long, a higher preference is found in the order with closer proximity between the numeral classifier and the noun (4b) (Amazaki, 2006: 23).

(4) a. San nin no **chuugokugo no** hootei-tuuyaku ga
three CLF GEN Chinese GEN court-interpreter NOM
manekareta.
invited

b. **Chuugokugo no** san nin no hootei-tuuyaku ga
Chinese GEN three CLF GEN court-interpreter NOM
manekareta.
invited

'Three court interpreters of Chinese were invited.'

2.2 The Postnominal Constructions

The postnominal constructions are frequently noted to be the *inventory* form for item enumeration (Greenberg, 1975), as in (5).

[1] The numeral classifier phrase is marked as CDU, which reads "CarDinal and Unit".

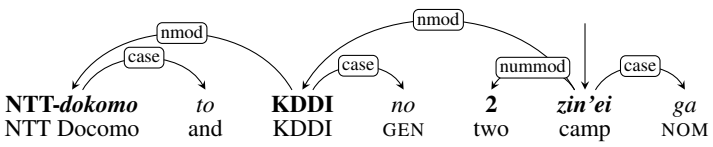
(5) zyookyaku hyaku yonzyuu go nin, zyooin hati nin
passenger hundred forty five CLF crew eight CLF
'a hundred and forty five passengers, eight crew members'

A relevant case regarding the role of processing efficiency in the choice of constituent order is when the numeral appears with a noun containing prenominal modifiers containing other numbers, as in (6). In this particular case, there is no ambiguity even if the numeral classifier phrase *kyuu mai* 'nine CLF' is placed at the front, but the current order should be easier to process.

(6) san gyoo san retu no paneru kyuu mai
three row three column GEN panel nine CLF
'nine panels of three rows by three columns'

Structural analyses of the postnominal constructions vary greatly in the literature. If we consider those that are widely adopted in large-scale studies involving corpora with cross-linguistic comparability, such as the Tübingen treebank referenced in the previous section or the GSD Japanese treebank (Asahara et al., 2018), the preferred analysis is to maintain a left-branching structure in Japanese, by identifying the classifier as the head. (7) shows a dependency grammar analysis provided by the GSD treebank. This example also demonstrates the summative function often found in the postnominal constructions. The noun is an enumeration list that can be summarized by the numeral classifier phrase.

(7)



'the two camps NTT Docomo and KDDI'

2.3 The Adverbial Construction

While the adverbial construction is very frequently postnominal, it is seldom grouped into the postnominal constructions, except when the order affects the possible readings. Amazaki (2006) claims that the order follows the sequence of domain setting by the noun and instantiation of quantity by the numeral classifier phrase, but example (8) taken from the same work shows how the semantic information also affects the readings given the same constituent order. The specificity of the instantiation domain is partially drawn from world knowledge. There are other scope interactions when the adverbial phrase measures for different semantic roles (Gunji and Hasida, 1999), or with multiple numeral classifier phrases measuring different dimensions (Levy and Oshima, 2003), but it will not be discussed here.

(8) a. Unagi o san biki katta.
eel ACC three CLF bought
'(I) bought three eels.'

b. Hakusen o san bon kesita.
white.line ACC three CLF erased
'(I) erased three of (the) white lines.'

It is easy to find instances in the adverbial construction with a long noun phrase heavily adnominalized, as in (9). The adverbial numeral classifier phrase is syntactically farther away from the noun, as compared with the NP-internal postnominal constructions. But if the contrast is drawn with the prenominal constructions, the adverbial position is able to address the competing needs for adjacency to the noun between the numeral classifier phrase and other noun modifiers. This supports an efficiency proposal to explain the postnominal order.

(9) Netto no naka ni hait-teru saabisu ken o nizyuu mai atumeru.
net GEN inside LOC enter-GER service ticket ACC twenty CLF collect
'(I) collect twenty service tickets that entered the net.'

3 A Postnominal Preference in Corpus Studies

3.1 Previous Studies

This article is not the first to note a postnominal preference in Japanese numeral classifier phrases. In his survey of the distributions of selected classifier constructions, Amazaki (2006) notes a prenominal inclination for the general classifier *tu*, the inanimate, generic classifier, but frequent postnominal appearance for the human classifier *nin*, which is a classifier with more semantic content. The main contributor for the difference is suggested to be their semantic values, as testified across two genres: newspaper articles (Saga), and Japanese literature (Aozora).

The corpus study of Tojo (2014) surveyed the distribution of "quasi-classifiers", which are defined as nominal classifiers that can be used with the question word *nan* 'how many'. Quasi-classifiers are more often used as nouns proper, and may even receive their own classifiers, e.g. *tenpo* 'store' in (1d, cf. 1a, with *tenpo* as the noun). It may not be immediately relevant to our case, but the study suggests an interesting relation between the high productivity of the postnominal position and the level of semantic information of the numeral classifier.

3.2 Study 1: GSD Treebank

I will first report my survey of the distribution of the numeral classifier constructions in the GSD Japanese treebank (Asahara et al., 2018), which is an accessible corpus with structural analysis. The results are presented in the

grouping of prenominal and postnominal, regardless of adverbialization, as given in Table 1. *Tu* and *nin* are the most frequent numeral classifiers, here and in other studies (e.g. Downing, 1996), so they are identified in separate rows. The prenominal preference is testified with the general classifier *tu*, which appears prenominal in 64% of occurrences that conform to any of our target constructions. However, with *nin* and other numeral classifiers, their positions are predominantly postnominal.

	% Prenominal	% Postnominal	Total
tu	64%	36%	78
nin	33%	67%	83
Other numeral classifiers	37%	63%	226
Nominal classifiers	27%	73%	41
Total	40%	60%	428

TABLE 1: Distribution of numeral classifier constructions with *tu*, *nin*, and other classifiers

Lexical items which participate in numeral classifier constructions but are tagged as nouns were categorized into nominal classifiers, and their percentage for postnominal constructions are even higher (79%). The situation sums to a general postnominal preference of 60%.

3.3 Study 2: BCCWJ

It has been noted more than once that the semantic content affects the distributions between prenominal and postnominal constructions. The next study picks two frequent numeral classifiers for further investigations using the Balanced Corpus of Contemporary Written Japanese, BCCWJ (Maekawa et al., 2014). The general classifier *tu* gives way to the next most frequent classifiers, the human classifier *nin* and the flat-object classifier *mai*. The data is further narrowed down to examples in the accusative case.

For ease of reading, the construction types in the results appear in abbreviations where Q denotes the numeral classifier phrase, *no* 'GEN', N the Noun, and C the case marker. Table 2 shows the correspondence to the classification system in Kim (1995), which has been presented earlier in (1). Prenominal adverbial construction is excluded for its scarcity.

Instances of *nin* and *mai* are extracted, and categorized for the five construction types in question. Results presented in Table 3 are divided into a prenominal group with the constructions Q*no*NC and QNC, and a postnominal group with the constructions N*no*QC and NQC, as well as the adverbial construction NCQ.

#	Construction type	Description
1	Q*no*NC	Prenominal, attributive, NP-internal
2	QNC	Prenominal, non-attributive, NP-internal
3	N*no*QC	Postnominal, attributive, NP-internal
4	NQC	Postnominal, non-attributive, NP-internal
5	NCQ	Postnominal, NP-external

TABLE 2: Constructions of interest

Type	*nin*	%		*mai*	%	
Q*no*NC	1165	55.9%		567	40.3%	
QNC	30	1.4%		75	5.3%	
			57%			46%
N*no*QC	66	3.2%		17	1.2%	
NQC	676	32.4%		194	13.8%	
NCQ	148	7.1%		554	39.4%	
			43%			54%
Total	2085		100%	1407		100%

TABLE 3: Distribution of the five constructions with *nin* and *mai* in BCCWJ (Maekawa et al., 2014)

The difference between the prenominal group and the postnominal group is not as dramatic as in the study with the GSD Japanese treebank, but again, a postnominal preference is noted next to the prenominal group. Semantic factors add to the minor variations between *nin* and *mai*.

It was noted in (9) that when a noun phrase is heavily adnominalized, the adverbial construction is able to balance the competition for adjacency with the head by placing the numeral classifier phrase in a postnominal position. This motivates the next step in this study. Further statistics concerning the lengths of NP and Q are presented separately for the two selected classifiers. Table 4 shows the results for the human classifier *nin*. Lengths are measured in morae as a phonological processing unit. For a fair comparison between NP-internal and -external constructions, what is meant by "length of NP" in subsequent text is actually the segment of the NP after removing Q(-*no*). Modifiers of Q are also removed.

The maximum length of NP goes up to sixty five morae in the N*no*QC construction. The maximum length of Q is thirty three morae in the NQC construction, which is just a few morae longer than the maximum in the pre-

		Length of Q				Length of NP			
	n	Mean	SD	Min	Max	Mean	SD	Min	Max
Q*no*NC	1165	5.92	2.73	3	29	4.32	2.13	1	18
QNC	30	5.90	2.09	3	11	3.53	1.48	2	9
N*no*QC	66	4.42	1.95	3	12	19.70	15.31	3	65
NQC	676	6.17	2.88	3	31	10.81	9.20	2	56
NCQ	148	5.32	1.82	3	12	9.25	6.52	2	33

TABLE 4: Statistics of Q and NP lengths for the five constructions with *nin*

nominal construction Q*no*NC at twenty nine morae. On average for all constructions, the length of Q is about five or six morae. The most significant difference between the prenominal group of constructions with Q*no*NC and QNC and the postnominal group of constructions with N*no*QC, NQC, and NCQ lies in the lengths of NP. The average NP length in the prenominal group is around four morae, which is smaller than the mean Q length. In the postnominal group, the mean NP length exceeds that of Q by a large portion, and goes up to 19.7 morae for the N*no*QC construction, with a wide standard deviation of 15.31. This suggests a correlation between the length of NP and the choice of numeral classifier position.

Similar statistics are shown in Table 5 for the flat-object classifier *mai*. The maximum length of NP goes up to only forty morae in the NQC construction, closely followed by other postnominal constructions. The maximum length of Q is much shorter than that of *nin*, topping at fourteen morae in the Q*no*NC construction. The Q length is also on average shorter, at four or five morae for all constructions. This difference in average lengths is related to the magnitude of the numerals that are used with the two classifiers, as a larger number occupies more phonological units. The maximum NP length with the prenominal group is dramatically short and not exceeding eight morae. Similar to the case of *nin*, the average NP length in the postnominal group is much longer than the prenominal group, by almost four times.

		Length of Q				Length of NP			
	n	Mean	SD	Min	Max	Mean	SD	Min	Max
Q*no*NC	567	4.34	1.53	3	14	3.17	1.24	1	8
QNC	75	5.05	1.56	3	11	3.08	1.06	1	7
N*no*QC	17	3.94	0.24	3	4	12.35	7.39	2	32
NQC	194	4.31	1.32	3	11	8.20	7.07	1	40
NCQ	554	4.18	1.10	3	11	6.91	4.73	1	36

TABLE 5: Statistics of Q and NP lengths for the five constructions with *mai*

The counts of the five constructions for the human classifier *nin* and the flat-object classifier *mai* did not show any preference for either prenominal or postnominal constructions, but when we look at the length distributions, we confirm that the choice of constituent order correlates with the constituent lengths.

3.4 Discussion

The postnominal numeral classifier constructions are seldom considered on equal terms with the prenominal constructions in Japanese, but their high frequencies as found in the two studies call for more attention. This may be able to reveal a processing motivation concerning the apparent non-correlation between numeral–noun order and head direction. At the least, classifier languages may need to be treated as a special subgroup in the discussion of numeral–noun order. I expect studies of other classifier languages to be confirmatory.

The length of the NP, whether measured in full or with Q removed, varies in magnitudes between the prenominal construction groups with Q*no*NC and QNC, and in the postnominal construction groups with N*no*QC, NQC, and NCQ. Currently the survey of length and order correlation is performed superficially, regardless of the structural difference especially between the NP-internal and -external constructions. Even so, this implementation dividing Q from the rest of the NP will enable us to work toward a general long-before-short preference when ordering two constituents in Japanese (Yamashita and Chang, 2001), as predicted by the performance theory of processing efficiency (Hawkins, 1994, 2004, 2014). Supports may need to be sought in directions that affirms the numeral classifier as a processing cue of comparable status with the noun.

The performance theory has been successful in explaining many asymmetrical word order alternations. With due respect of the status of the noun as the head in the postnominal constructions, the inefficiency of the broken left-branching structure is overcome by the long-before-short preference. This illustrates the competition between different efficiency tendencies, rather than challenging the omnipresent tendency for processing efficiency in general.

4 A Processing Efficiency Account

The efficiency principles from the performance theory provide neat predictions for asymmetrical word order variations (Hawkins, 1994, 2004, 2014). In a greater context, the theory predicts grammatical patterns from the influence of performance data. It will be beneficial to consider our case of Japanese numeral classifier position in the context of the numeral classifier class in general, and its relation to the noun class with shared semantic contents. In particular, the open status of Japanese classifier class is related to the possibility of the numeral classifier phrase to adverbialize into a postnominal position.

4.1 The Numeral Classifier Class

It is generally accepted that numeral classifiers are the products of grammaticalization from full nouns (Bisang, 1993; Aikhenvald, 2000). Downing's (1996) inventories of numeral classifiers sum to seventy four. Other studies maintain lists that go up to 360, with the inclusion of many nouns that can also serve as numeral classifiers. This is suggestive of the openness of the classifier class, with unending grammaticalization based on the class of nouns.

The corpus study of Tojo (2014) surveyed the distribution of quasi-classifiers, as a sub-class of nominal classifiers that can be used with the question word *nan* 'how many'. It is considered a standard behavior for fully grammaticalized numeral classifiers. The list of quasi-classifiers includes items that are often used for unitization in non-classifier languages, such as *syurui* 'type' and *guruupu* 'group'. Frequencies are listed by four possible constructions, which are a subset of the five constructions given in Table 2, with the absence of QNC. I aggregate the frequencies into Table 6, which shows type and token counts of the quasi-classifiers in decreasing number of possible constructions.

These quasi-classifiers, or nominal classifiers, may demonstrate a very different distribution from true classifiers that have reached completion in grammaticalization. Nonetheless, a hierarchy of construction types (10) is noted by the percentage of quasi-classifier types that can occur in each construction. Postnominal constructions appear on both ends of the hierarchy, with the highest number of membership in the NP-internal constructions, and the lowest number in the adverbial construction.

(10) NQC (77%) > N*no*QC (69%) > Q*no*NC (38%) > NCQ (17%)

More insights in the matter may be drawn from the distribution of case particles used with NP-internal and -external constructions, as presented in Table 7 (Downing, 1984: 212). The NP-external construction presupposes NCQ only, as the prenominal adverbial construction is not addressed in Downing (1984). The percentages sum to 100 for each row. The dominant cases are highlighted in bold. In this survey with five modern works of fiction, the NP-external construction is dominant in the basic case of intransitive subject (suffixed by *ga*, in bold) and with the topic marker *wa*.

In the accusative case (suffixed by *o*, also in bold), the NP-internal and -external types are as frequent. It strikes a resemblance with our second study with accusative instances in BCCWJ. But if we consider that in Table 7, the NP-internal case may be prenominal or postnominal, while the NP-external case is exclusively postnominal, we see a different picture. Other than these, the external construction is not possible only other case markers except *no* '*gen*', but it is difficult to judge given the small numbers for other cases.

Synthesizing the two studies, there is a postnominal preference for both

No. of possible constructions	Construction				Type	Token
	NQC	N*no*QC	Q*no*NC	NCQ		
4	**Y**	**Y**	**Y**	**Y**	**9**	**881**
3	**Y**	**Y**	**Y**	**–**	**21**	**402**
	Y	Y	–	Y	3	37
	–	Y	Y	Y	2	34
	Y	–	Y	Y	1	7
2	**Y**	**Y**	**–**	**–**	**39**	**430**
	Y	–	Y	–	8	35
	Y	–	–	Y	2	15
	–	–	Y	Y	2	12
	–	Y	Y	–	2	4
	–	Y	–	Y	1	2
1	**Y**	**–**	**–**	**–**	**20**	**57**
	–	Y	–	–	15	23
	–	–	Y	–	6	18
	–	–	–	Y	3	10
Type	103	92	51	23	134	
%	77%	69%	38%	17%	100%	
Token	889	539	452	77		1967
%	46%	27%	23%	4%		100%

TABLE 6: Type and token count of quasi-classifier constructions (reanalysed from Tojo 2014)

Type	**Intr. *ga***	Tr. *ga*	***o***	*ni*	*de*	*to*	*no*	*wa*	*mo*	Total
Internal	**32**	1	**21**	3	2	7	5	3	1	75
%	**43%**	3%	**28%**	4%	3%	9%	7%	4%	1%	100%
External	**65**	3	**25**				1	10		104
%	**63%**	3%	**24%**				1%	10%		100%
Total	**97**	4	**46**	3	2	7	6	13	1	179

TABLE 7: Distribution of noun particles used in introductory mentions involving NP-internal and -external constructions (Downing, 1984)

nominal classifiers and fully grammaticalized numeral classifiers, the latter of which still contains considerable semantic content. The difference between the two classes lies in their ability to adverbialize.

4.2 Interaction of MiD and MaOP Principles

Various studies presented in this article point to an efficiency motivation for the postnominal position of Japanese numeral classifiers, as predicted by the Minimize Domains (MiD) principle discussed in Hawkins (1994, 2004, 2014). It prefers a short distance between a nominal element with a semantic role and the verb.

A particular case that requires further explanation is when the postnominal Q appears with only a short N in front. I propose it to be a tug-of-war involving another efficiency principle, the Maximize Online Processing (MaOP) principle. It favors the early appearance of a nominal element to avoid mis-/unassignment of semantic roles, whereas the MiD principle prefers a later appearance of the host noun or a copy of it, for closer proximity with the strictly sentence-final verb in Japanese. When the classifier can supply semantic information in a close position to the verb, the host noun responds to a pull to an earlier position.

A very long numeral as illustrated in (11) supplies measurement information without interrupting the relation between the noun and the numeral classifier. It may serve as a bonding glue between the two constituents being pulled to different directions by the distinct efficiency principles.

(11) MaOP ⟵〰〰〰〰〰〰〰〰〰〰〰⟶ MiD

sidooin	*sen-kyuuhyaku-zyoo-iti*	*nin*	*o*	*haiti-suru*
instructor	thousand-nine.hundred-ten-one	CLF	ACC	station-do

'to station a thousand nine hundred and eleven instructors'

In the structure such as (11), we propose that the numeral classifier serves to be a reduced copy of N, and it facilitates sentence processing. This proposal may have implications for classifier languages to be treated as a special subgroup in studies of word order variations.

5 Conclusion

This article reported two studies using performance data, both showing that the postnominal numeral classifier constructions are far from being a minority in Japanese. At times internal to the noun phrase or adverbialized, postnominal numeral classifier phrases are the majority in some cases. The main reason that they are preferred is proposed to be the general long-before-short preference in Japanese under the Minimize Domains principle.

These results have implications for the processing of noun phrases in Japanese and possibly other classifier languages. The semantic content provided by the classifier contributes to the placement problem of the numeral closely related to it. The position of the numeral receives special attention with the relative orders of other two modifiers of the noun, namely the demonstratives and adjectives. This study may be able to reveal a processing motivation con-

cerning the apparent non-correlation between numeral–noun order and head direction.

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