

Floating Numeral Quantifier Constructions in Japanese and Combinatory Categorical Grammar

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Abstract

The paper investigates the information structure that licenses the Japanese floating numeral quantifier (FNQ) in terms of prosody and context from the point of view that the pitch reset on the FNQ affects the information structure and plays a crucial role in determining the interpretation of the FNQ. First, I argue that FNQ sentences are potentially ambiguous between an event-quantifier reading (i.e., a VP-related FNQ reading), and an object-quantifier reading (i.e., an NP-related FNQ reading) where such a reading is possible. The syntactic and semantic difference yields distinct prosodic phrasings (in accordance with information-structure) which contribute to the disambiguation of the two readings and the grammaticality. Second, I show how the prosody-syntax view can be integrated into the framework of Combinatory Categorical Grammar.

Keywords: Floating numeral quantifiers, Prosody, Information structure, Categorical grammar

1. Introduction

This paper focuses on the interpretation of subject-oriented Japanese floating numeral quantifiers (hereafter FNQs) such as *nana-nin* ‘seven people’ in example (1).¹ In this paper the term “floating numeral quantifier” is used as a neutral descriptive label. Our interest lies in the possibility of the development of a new analysis of the FNQs in terms of prosody and context. More specifically, this paper argues that information structure often plays a crucial role in FNQ placement and interpretation, in conjunction with the consideration of the interaction between structure and intonation.

In many languages the floated word order has been analyzed as a focus realization in the (subject-oriented) FNQ sentence where the FNQ is focused, as seen in (1a). There is also evidence that FNQs in Japanese exhibit another focus effect: when the subject (host) noun bears focus, as in (1b), the floated word order appears disfavored, but still possible. This fact has not been discussed in the literature (except Yamamori 2006). In the examples below, the quantifier is *italicized* and its host noun **boldfaced**. The abbreviation Cl stands for classifier.

(1) (‘//’ indicates a prosodic boundary. The words in capitals are emphatically stressed.)

a. Q: How many students read a book?

A: **Gakusei** *ga* // *NANÁ-nin* hón o yónda(yo).

student Nom 7-Cl book Acc read

‘Seven (of the) students read a book.’

b. Q: Who read a book?

A: **GAKUSEI** *ga nan á-nin* // hón o yónda(yo).

student Nom 7-Cl book Acc read

‘Seven (of the) students read a book.’

The presence of focus-induced readings with FNQs, as exemplified in (1), strongly indicates that there is a certain correlation between prosodic patterns and contextual effects, and that information structure (or focus structure) should be considered a key notion which is used in order to account for such a correlation (see Jackendoff 1972, 2007 for a similar view). In the following section, I examine in detail how the primacy of FNQ interpretation is determined according to the information status (e.g., focus/non-focus patterns) in a given context.

2. Prosody and Interpretation of FNQs

Interpretive issues involved with Japanese FNQ phenomenon have been discussed in the literature: the distinction between distributive and non-distributive readings; partitive and non-partitive readings (see Kitagawa and Kuroda 1992; Ishii 1998, 1999; Kobuchi 2003, 2007; Nakanishi 2004, 2007, 2008). What is of immediate interest is that the interpretation of the FNQ sentence can alter contingent upon the prosodic pattern. Nakanishi (2007, 2008), for

¹

example, mentions the presence of a prosodic boundary influences the interpretation of the sentence: sentence (2) is ambiguous between distributive and collective (non-distributive) readings without a prosodic boundary, whereas it only allows a distributive reading with a boundary.

(2)

Gakusei ga (//) *go-nin* tsukue o mochiage-ta.

student Nom 5-Cl desk Acc lift-Past

(i) ‘Five (of the) students lifted a desk (individually).’ **[Distributive]**

(ii) ‘Five students lifted a desk (together)’ **[Non-distributive]**

(Nakanishi 2007, 2008)

To avoid such a potential ambiguity that resides in Japanese FNQ expressions, Nakanishi focuses on a case where some element (e.g., *kinoo* ‘yesterday’) intervenes between an FNQ and its host subject noun. However, as she admits herself in her study, it is inevitable to question as to what implications of such data presented in (2) and others have to the theory of Japanese FNQ constructions.

To deal with the apparent complexity around FNQ interpretation, provided in (1) and (2), I will classify FNQs into two types (i.e., NP-related and VP-related FNQs), based on interpretative facts (under conditions in which syntactic and semantic constituency coincide) and prosodic patterns displayed. The NP-related FNQs correspond to the view that FNQs are adnominal (see, e.g., Fitzpatrick 2006; Miyagawa and Arikawa 2007), and the VP-related FNQs to the view that FNQs are adverbial (see, e.g., Gunji and Hasida 1988; Kobuchi 2003, 2007; Nakanishi 2004, 2007, 2008). Such a meaning difference can be attributed to a general semantic constraint that the NP-related quantifier quantifies the object (or entity) denoted by the host noun, whereas the VP-related quantifier quantifies the event described by the verbal predicate.

Prosody often helps the reader/listener to choose the intended interpretation of an FNQ sentence, as discussed in Yokota (2010). Each FNQ can be realized distinctly in the sentence, as exemplified in (3a, b) with relevant contours in Figures 1 (i) and (ii), and Figure 2.² Note that Figure (i) suggests that there is no syntactic boundary between the host noun and the FNQ, while Figure (ii) indicates the existence of such a boundary (which presumably implies that it is an accentual phrase (AP) boundary not an intermediate phrase (IP) boundary). A general characterization obtains that NP-related FNQ sentences tend to be packaged prosodically as one large unit with internal structure consisting of two morpho-

² The pitch tracks, as shown in Figures 1 and 2 below, are based on tokens produced by a male Tokyo-Japanese speaker in his late thirties who is a researcher in natural language processing at a communication technology company in Tokyo. Every pitch-track diagram presented in the figures was picked from three to four similar diagrams of the recordings. In the recording, the speaker was presented with the accompanying context, such as (3a) and (3b), and asked to read (aloud or silently) the context sentences. After reading each context sentence and understanding it, the speaker produced each target sentence for the recording.

syntactically-separable phrases and the FNQ exhibits downstep (or absence of sharp F₀ rise) as in Figures 1(i) and (ii), whereas VP-related FNQ sentences do not show such a prosodic integration, but pitch register reset (i.e., FNQ begins with sharp F₀ rise) as in Figure 2.³ Note that in the present analysis the presence/absence of pitch reset on the FNQ (rather than the pause occurring immediately before the FNQ) plays an important role in the interpretation of FNQ sentences.

(3)

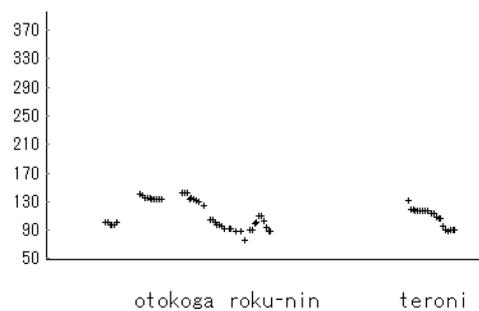
- a. (I heard that six people got involved in terrorism. But who was it that got involved in the accident?)

OTOKÓ ga *rokú-nin* // *téroni* *makikom-áre-ta.*

men Nom 6-Cl terrorism in involve-Pass-Past

‘Six (and only six) men got involved in terrorism.’

(i)



(ii)

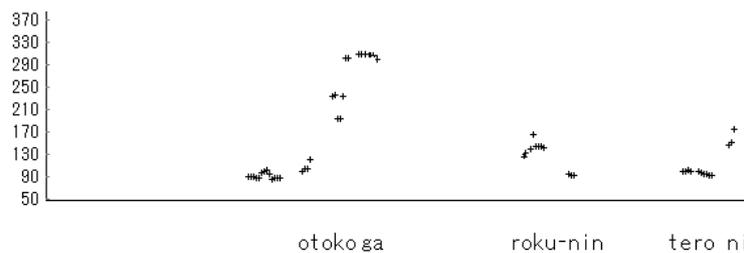


Figure 1. Pitch contours for (3a): Pitch reset on FNQ is not observed in (i) nor (ii).

- b. (I heard that some men who happened to be there got involved in terrorism. But how many got involved?)

³ It is not a settled issue that the F₀ rise at a focused phrase is an instance of “pitch register reset”. There are two lines of analyses for the prosodic effects induced by focus. One line of analysis claims that focus inserts a prosodic boundary on its left (hence induces a pitch register reset), and removes all the subsequent prosodic boundaries (hence induces downstep) (along the line of Pierrehumbert and Beckman 1988). The present paper follows this position. On the other a hand, there have been claims that the F₀-rise at a focused phrase and the F₀-reduction/compression after a focused phrase (so-called post-focal reduction) is independent of prosodic phrasing (Poser 1984). See Sugahara (2003), Kubozono (2007), Ishiahra (2011) and others for relevant discussion.

Otok ó ga // ROKÚ-nin t éro ni makikom- áre-ta.
 men Nom 6-Cl terrorism in involve-Pass-Past
 ‘Six (of the) men got involved in terrorism.’

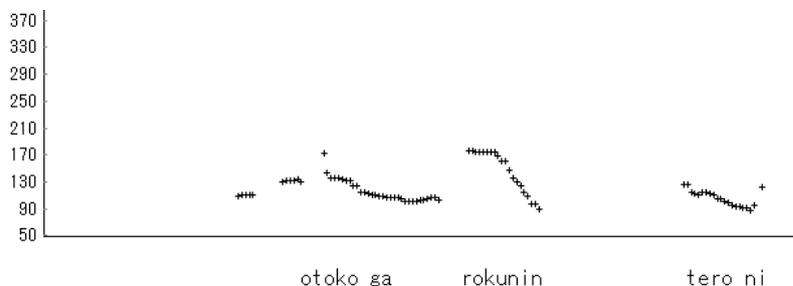


Figure 2. Pitch contour for (3b): Pitch reset is observed on FNQ.

A fruitful methodology for capturing Japanese FNQ constructions in the literature has been the examination of materials in the written (or printed) mode. Yet, as Kitagawa and Fodor (2006) argue, written data remain silent about the prosody of a construction. Then, what is left unexplored in the literature is the motivation and determination of the FNQ’s location and interpretation derived. In order to address this research issue, relevant prosody and information structure need much further investigation and analysis. Examples (1) through (3) demonstrate that information structure is significantly influenced by prosody. The distinction between the prosodic phenomenon (e.g., pitch reset) and the semantic phenomenon (e.g., focus) should be made clearly. I assume that it is the effect of focus/non-focus that is crucial for the interpretation of FNQs. Furthermore, the relation between information structure and prosody is the key to better understanding discourse effects such as distributivity and partitivity in licensing FNQ sentences, as shown in (3a) and (3b).

NP-related FNQs are harder to obtain than VP-related FNQs, which are canonical; Secondly, the difficulty associated with NP-related FNQs can be reduced by (supportive) contextual factors such as information structure, but not eradicated completely. Whereas no previous claim can make the relevant predictions for those experiments, the analysis of FNQs carried out from a prosodic and information structure perspective does account for interpretive issues around FNQs.

To accommodate the considerations so far, a flexible syntactic theory which enables us to capture straightforwardly the issues of FNQ structure and prosody is necessary. CCG by Steedman (1996, 2000a, b) is such a theory. This grammar model makes it clear that intonation determines which of the many possible bracketing (or structuring) permitted by the ‘combinatory’ syntax of Japanese is intended, and that interpretations of the constituents are tightly related to distinctions of information-structural significance among the concepts that the speaker has in mind, which I will spell out in the next section.

3. A CCG Account

To see how the desired prosodic effects are derived, what we need to do is seek an analysis of two types of FNQs, as discussed in section 2, in the framework of CCG. For this purpose, I

propose that **Type I** (for NP-related FNQs) is lexically different from **Type II** (for VP-related FNQs), as defined in (4) and (5) below, where the forward and backward slashes indicate whether a given category behaves as a modifier or an element taking an argument. In other words, Type I and Type II apparently differ only in terms of the order of composition. In (4), the ‘*’ modality on the slash of the category for the Type I quantifier prohibits the quantifier from combining with categories other than NP because it is incompatible via the backward composition (*BC*) rule, as exemplified in (4a). On the other hand, the Type II quantifier is allowed to combine with the verb as well as the host noun because of the ‘◇’ modality on the slashes of this category, as in (5a) (see Steedman and Baldridge 2007 for the explanation of modalities employed in CCG). Another important assumption, as provided in (4b) is that a NP-related FNQ functions as an anaphoric pronoun. Given that the anaphorically deaccented phrase contributes to the domain restriction of quantification of an NP-related FNQ, the term ‘*ana*’ *x*’ in (4b) can be similarly represented as an anaphor bound to the (interpretation *x* of the) subject of the control verb (see Steedman 2000a, b).⁴

- (4) a. **Type I:** $S/(NP \backslash S) \setminus *S/(NP \backslash S)$
 b. *nana-nin* ‘seven-Cl’ $\Leftrightarrow S/(NP \backslash S) \setminus *S/(NP \backslash S): \lambda f. \lambda x. ([|f|=7](ana' x)) x$
- (5) a. **Type II:** $NP \backslash S / \diamond NP \backslash S$
 b. *nana-nin* $\Leftrightarrow NP \backslash S / \diamond NP \backslash S: \lambda y. [|y|=7]$

I will show how the discourse property follows from the basic syntax of the FNQ construction. The example of CCG derivation in example (6) below, with relevant information partitioning, illustrates how the present assumption works and verifies the existence of a class of NP-related FNQs in Japanese. To serve as a foundation for an account, I will adopt a general framework of Steedman (2000a, b) for representing informational dichotomy using *theme/rheme* sentence-structure assignment, along with possible phrasal components and a possible distribution of focus/background structures (in the third lines of the target sentence).

(6) *Example of NP-related FNQ:*

Context: I’ve heard that seven people got involved in an accident. But what kind of accident?

Target:	Seijika ga	<i>nana-nin</i>	//	TERO ni	makikomareta-n-desu.
	politician Nom	seven-Cl		terrorism in	got involved-Nominal-Cop
	[<i>Th</i> Focus	Background]		[<i>Rh</i> Focus	Background]

⁴ This type of semantics can be presumably substantiated in terms of information (focus/non-focus) structure by adopting the definability of the restriction and scope of quantification making use of the tripartite quantificational structure; Quantifier, Restriction, and Nuclear Scope (see Heim 1982; Partee 1991 for details). In this framework, the focused chunk is in the nuclear scope and the non-focused chunk is restriction of quantification. This may be a crucial semantic and pragmatic condition to make an FNQ sentence acceptable.

‘Seven (and only seven) politicians got involved in terrorism.’

Assuming that in general topics are given (or generally presupposed) and foci are new in the discourse, the question-answer utterance follows since the answer to the *wh*-question is necessarily new, and the rest of the sentence is either presupposed, which is present in the question, or non-presupposed, which is absent in the question. The denotation of an FNQ is potentially either in focus or non-focus (e.g., background), each of which has distinct prosodic realization, as discussed in (3) above. The underlying assumption here is that in spoken utterances, intonation helps to determine which of the many possible bracketing structure permitted by the combinatory syntax of Japanese is intended.

To see how the semantic interpretation making use of (4a) is calculated compositionally, I show a derivation in a simplified version of CCG in Figure 3. The point to observe is that the type and meaning of an FNQ is sensitive to the order of composition, affecting the FNQ interpretation.

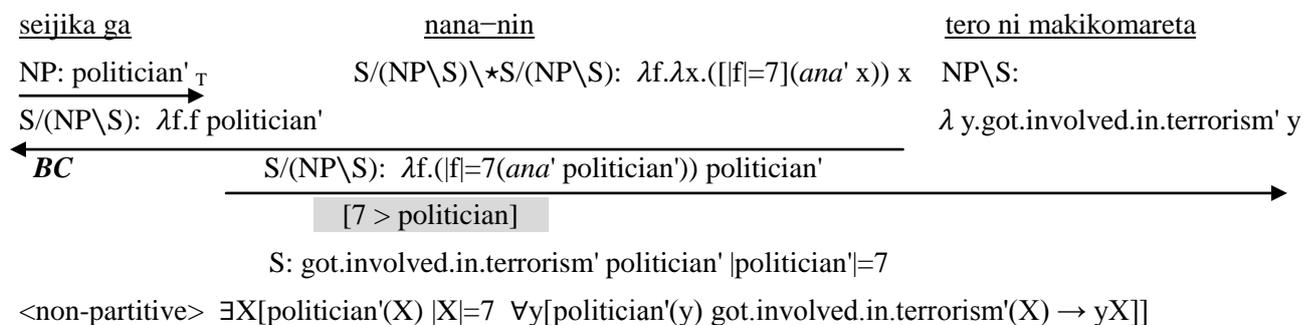


Figure 3. Sample derivation of (6)

Note that in the above derivation the NP-related FNQ takes wide scope over the host noun, resulting in non-partitive (or exhaustive) interpretation. Following de Swart (1996) in that indefinite NPs are interpreted as existential quantifiers (see de Swart (1996) for discussion), I render scope relations between noun phrases as scope statements (shaded in the figures) of the form $x < y$ expressing that the term involving variable y has scope over the term involving x . With this representation, in the computation of sentence meaning the composition of the subject NP and the FNQ must occur prior to composition with other elements of the sentence (here, the VP). This derivational property crucially constitutes the interpretation of NP-related FNQs.

Next, let us consider an example of VP-related FNQs in (7), which is intended to elicit an answer of the quantity of the given property, specifically, of ‘how many of men’. In contrast to the target sentence in (6), when the quantifier *nana-nin* is highlighted by focus, the target sentence in (7) exhibits an intonational phrase break immediately before the quantifier, accompanied by pitch reset. What is to be noted in (7) is that the target sentence is read with an intonational pattern different than that of (6), as we have seen in the F0 pitch contours indicated in Figure 2.⁵ In the case of VP-related FNQs, a quantifier typically obtains

⁵ Another possible realization of the prosody of sentence (7) would look like (*seijika ga*) (*nana-nin*) (*tero ni makikomareta-n-desu*), where the FNQ ‘*nana-nin*’ stands alone in an independent intonational phrase.

prominence because it is considered as the most informative in the informational unit, often accompanying a (dramatic) drop of F0 contour, often referred to as “post-focal reduction/compression” (see Sugahara 2003 and Ishihara 2011) .

(7) *Example of VP-related FNQ*

Context: I’ve heard that some people got involved in terrorism. But how many?

Target: **Seijika ga // NANA-ni tero ni makikomareta-n-desu.**
 politician Nom seven-Cl terrorism in got involved-Nominal-Cop
 [_{Th} Background] [_{Rh} Focus Background ...]
 ‘Seven (and only seven) politicians got involved in terrorism.’

A sample derivation exploiting (5a) can be represented below. Note that in the fourth line of the figure the scope statement (shaded) indicates that the host noun has scope over the quantifier, resulting in a partitive reading.

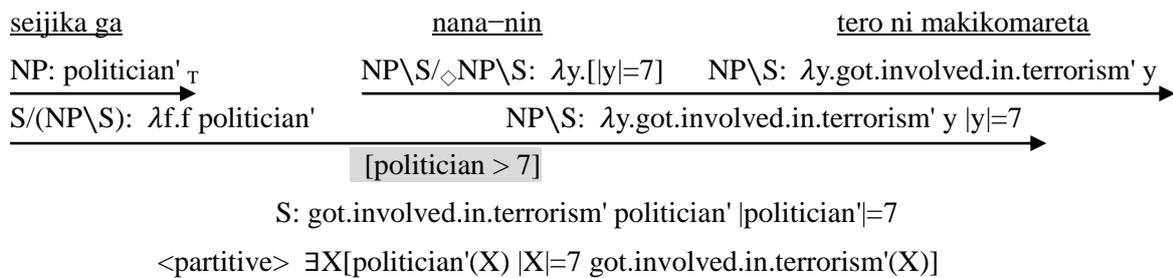


Figure 4. Sample derivation of (7)

4. Conclusion

The analysis developed in this paper has some firm empirical grounding: in light of the difference of informational structuring, there are certainly some cases when FNQs receive NP-related interpretations. I have argued that the difference in intonational phrasing ultimately lies in the information-structure. This is particularly reflected as the presence/absence of pitch reset on the FNQ. In terms of prosody, it can be said that local NP-related FNQs (see Figure 1(i)) and non-local NP-related ones (e.g., Figure 1(ii)) are identical if an FNQ forms a single intonational phrase (or prosodic constituent) with the subject NP, in spite of the difference in surface structure (or morpho-syntactic constituent). This suggests that the Japanese FNQ should be defined as an instance of expressing a discourse relation, not merely an argument-head relation, pace earlier studies.

This phrasing does not affect the point in the current discussion. What is the most important is that there exists a pitch reset at the initial position of the FNQ, as can be in Figure 2.

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