

CCG of Questions and Focus

Sumiyo Nishiguchi

Tokyo University of Science

1. Categories of Questions and Focused Sentences

In Combinatory Categorical Grammar (CCG) (Steedman 1996, 2000, Szabolcsi 1987), questions and focused sentences have been considered to be categories of S. In Type Logical Grammar (TLG), Jäger (2005) terms questions to be a separate category q , and Barker and chieh Shan (2006) marks such types of clauses with modalities in multi-modal TLG. In spite of such treatment, questions have been considered to be sets of possible answers from semantic perspectives (Hamblin 1973). Pragmatically, focus induces a set of alternatives (Rooth 1985, 1992).

A question we will consider in this paper is: should semantics of questions and focus be reflected not only in semantics and types but also in syntactic categories (Hamblin 1973, Rooth 1996)? The hypothesis of direct compositionality assumes that syntax and semantics work together in tandem, and every syntactic operation does not occur without corresponding semantic outcome (Barker and Jacobson 2007).

I claim that interrogatives and focused sentences should be functions from a sentence to another sentence in view of their semantics (Hamblin 1973, Rooth 1985, 1992). Such novel categories enable combining with the following sentence in a discourse by means of functional application.

While word order signals questions and exclamatives in English, as in *Is Susan happy?*, the presence of sentence-final particles such as *ka* marks questions in Japanese. What are the categories and meanings of Japanese sentence-final particles? In particular, I analyze particles such as *yo* and certain types of *ne* as verum, or polarity focus operators (Höhle 1992, Romero and Han 2004) and *ka*, *no*, *ne*, *na*, *ke*, and *kashira* as question markers. Given such semantics, their categories are $S \setminus (S \setminus S)$.

The treatment of focus and questions proposed in this paper no longer calls for modalities—syntax and semantics work together in tandem.

2. Modality in CCG and TLG

2.1 Steedman (2000): Prosodically Annotated Categories

In CCG, questions, focused sentences and exclamatives have been considered to be of the category S, or a sentence. Even so, Steedman (2000) specifies features for focused sentences. For example, while a transitive verb *eat* would be a function from a noun

phrase (NP) to another function from NP to a sentence (S), Steedman (2000, 112) uses prosodically annotated categories. He defines the category INFORMATION for theme and rheme values of focused elements as in (1).

- (1) a. theme:
 $ate := (NP_{\theta} \setminus S_{\theta}) / NP_{\theta} : *ate'$
 L+H*
- b. rheme:
 $ate := (NP_{\rho} \setminus S_{\rho}) / NP_{\rho} : *ate'$
 H*

The categories without these features are unspecified as to the value of the feature INFORMATION so that they can combine with any of the specified, or featured categories and return the unspecified value.

2.2 Barker and chieh Shan (2006)

Barker and chieh Shan (2006), in multi-modal TLG, term questions to be the category of $?S$.

2.3 Jäger (2005)

Jäger (2005) terms questions as the category q , and *wh*-phrases as the category $q / (np \uparrow s)$.

2.4 Hockenmaier and Steedman (2007)

In Hockenmaier and Steedman (2007), the category S typically carries a feature that distinguishes sentence types—declaratives (S[dc]), *wh*-questions (S[wq]), yesno questions (S[q]), or fragments (S[frg]).

3. Proposal: Higher Order for Questions and Polarity Focus

Even though the proposed modalized sentence categories such as q and $?S$ are useful for controlling combinatorics, such modality is not really necessary if syntax-semantics correspondence is more strictly pursued.

In the previous analysis, there exists a mismatch between syntactic categories and semantics of questions and focused sentences. Semantically speaking, a question or a focused sentence is a set of propositions. For example, the interpretations of an interrogative in (2) is a set of possible answers in a given context (Hamblin 1973, Karttunen 1977).

- (2) $\llbracket Did_you_see_Alice? \rrbracket = \{ \text{you saw Alice, you did not see Alice} \}$

Contact: Sumiyo Nishiguchi, School of Management, Tokyo University of Science, 500 Shimokiyoku, Kuki-city, Saitama, 346-8512, Japan, #81-480-21-7600, nishiguchi@rs.tus.ac.jp

Since a proposition is a set of possible worlds which is of type $\langle s, t \rangle$, the set of possible answers is a set of sets of possible worlds, namely, type $\langle st, t \rangle$.

Focus induces sets of alternative propositions (Rooth 1985, 1992). For example, the answer to the question *Where did you go?* is *I went to the beach* in (3a), in which *the beach* is focused. The beach is contrasted with other candidate places where the speaker could possibly have been to, such as shopping, hiking, and others. The alternative answers along with the real answer form a set of contextually possible answers called focus semantics value (“f”). Such a focus-induced alternative set does not have any truth-conditional contribution. On the contrary, the ordinary semantics value (“o”) of the answer *I went to the BEACH* is the proposition itself, that is, *I went to the BEACH*, which does have truth-conditional meaning.

- (3) a. A: Where did you go on weekend?
B: I went to the BEACH.
- b. $[[I_went_to_the_BEACH]]^f$
= {I went shopping, I went hiking, I stayed home,...}
- c. $[[I_went_to_the_BEACH]]^o$
= I went to the beach

The hypothesis of direct compositionality assumes that the syntax and the semantics work together in tandem. Every expression that is computed in syntax has meaning (Jacobson 2002, Barker and Jacobson 2007).

The semantic type of questions and focused sentences $\langle st, t \rangle$ more straightforwardly correspond to type $S \setminus S$ rather than S_Q or S_{foc} even though there is no syntactic composition of two sentences. Therefore, I propose the following lexical entries.

- (4) a. A polar question: $S \setminus S: \{p, \neg p\}$
b. A focused sentence: $S \setminus S: \{p, q, r, \dots\}$

Such novel categories adequately handle discourse:

- (5) a. Who came?
b. Mary did.

$$\frac{\frac{who \quad came?}{S \setminus S} \quad \frac{Mary \quad did.}{S}}{S} >$$

4. Categories of Sentence-final Particles in Japanese

4.1 Syntactic Behavior

Given that Japanese is a SOV language, sentence-final particles may attach either to a verb as in (6a), a modal in (7a) or a tense marker in (8a), which fall in the end of sentences. These particles are generally ungrammatical elsewhere other than the sentence-final position as shown in (6b), (7b), and (8b), except for *ne* and *na* which may attach to a case marker such as the nominative marker *ga* in (7c).

- (6) a. So-da-**yo**.
so-be-PAR
“That’s right, isn’t it?”
b. (***Yo**)-so-(***yo**)-da.
so-PAR-be
“That’s right, isn’t it?”
- (7) a. Ken-ga hanashi-ta-rashii-**ne**.
Ken-NOM speak-PAST-EVI-PAR
“It seems Ken has spoken, hasn’t he?”
b. Ken-ga hanashi-(***ne**)ta-(***ne**)-rashii.
Ken-NOM speak-PAR-PAST-PAR-EVI
“It seems Ken has spoken, hasn’t he?”
c. Ken-ga-**ne** hanashi-ta-rashii.
Ken-NOM-PAR speak-PAST-EVI
“It seems Ken has spoken, hasn’t he?”
- (8) a. O-namae-wa nan-deshi-tak-**ke**.
HON-name-TOP what-HON-PAST-PAR
“What was your name?”
b. O-namae-wa (***ke**)-nan-(***ke**)-deshi-(***ke**)-ta.
HON-name-TOP PAR-what-PAR-HON-PAR-PAST
“What was your name?”

4.2 Meaning of Sentence-final Particles

These particles often convey subtle nuances although many appear to be question or exclamative markers which turn the sentences into questions or exclamatives.

While Masuoka and Takubo (1992) provide descriptive meaning of sentence-final particles, there has not been much formal descriptions of these sentence-final particles so far in my knowledge. The literature from the pedagogical view point, such as Chino (2001), lists Japanese sentence-final particles such as *no*, *ne*, *yo*, *na*, *ke*, *mono*, and others and describe their meanings. Only literature from theoretical perspectives are Takubo and Kin-sui (1997) which discuss information-sharing marked by sentence-final particles from pragmatic viewpoint, and McCready (2007) which presents an analysis on dynamic semantics and relevance theory.

In harmony with their syntactic position as sentence-final particles, semantically speaking, the sentence-final particles take a proposition as the argument and returns a set of propositions. Table 1 defines them as functions from a proposition to a set of propositions.

Semantically speaking, these particles are functions from a proposition to a set of propositions. For example, *no* as a question marker is a function from a proposition to a set of possible answers in a given context (Hamblin 1973). The meaning of (9a) is a set of propositions as in (9b).

- (9) a. Arisu-o mi-ta-no.
Alice-ACC watch-PAST-PAR
“Did you see Alice?”
b. $[[Did_you_see_Alice?]] = \{ \text{you saw Alice, you did not see Alice} \}$

particles	Masuoka and Takubo (1992)	Chino (2001)	proposal	categories	terms
<i>ka</i>	question		a question marker/ an exclamative marker	$S \setminus (S \setminus S)$	$\lambda p_{\langle st \rangle} . \lambda w_{\langle s \rangle} . q_{\langle st \rangle}$ [$q=p \vee q=\neg p$]
<i>no</i>	N/A	question/command	a question marker/ a polarity focus operator (Höhle 1992) (Romero and Han 2004, cf.)	$S \setminus (S \setminus S)$	$\lambda p_{\langle st \rangle} . \lambda w_{\langle s \rangle} . q_{\langle st \rangle}$ [$q=p \vee q=\neg p$]/ $\forall w' \in wRw'$ [$p(w') = 1$]
<i>ne</i>	agreement/ affirmation	admiration/agreement /request softener	a tag question marker	$S \setminus (S \setminus S)$	$\lambda p_{\langle st \rangle} . \lambda w_{\langle s \rangle} . q_{\langle st \rangle}$ [$q=p \vee q=\neg p$]
<i>yo</i>	notification	urges a course of action/ request/certainty	a polarity focus marker	$S \setminus (S \setminus S)$	$\lambda p_{\langle st \rangle} . \lambda w .$ $\forall w' \in wRw'$ [$p(w') = 1$]
<i>na</i>	agreement/ affirmation	indicates emotion/ asks for agreement	a question marker / an exclamative marker	$S \setminus (S \setminus S)$	$\lambda p_{\langle st \rangle} . \lambda w_{\langle s \rangle} . \lambda q_{\langle st \rangle}$ [$q=p \vee q=\neg p$]
<i>ke</i>	affirmation of memory	question for recalling shared information	a question marker	$S \setminus (S \setminus S)$	$\lambda p_{\langle st \rangle} . \lambda w_{\langle s \rangle} . \lambda q_{\langle st \rangle}$ [$q=p \vee q=\neg p$]
<i>kashira</i>	N/A	uncertainty/question /request	a question marker	$S \setminus (S \setminus S)$	$\lambda p_{\langle st \rangle} . \lambda w_{\langle s \rangle} . \lambda q_{\langle st \rangle}$ [$q=p \vee q=\neg p$]

Table 1. Categories and Terms of Japanese Sentence-final Particles

The semantic type of sentence-final particles $\langle st, \langle st, t \rangle \rangle$ more straightforwardly correspond to type $S \setminus (S \setminus S)$ rather than $S \setminus S_Q$ or $S \setminus S_{foc}$ even though there is no syntactic composition of two sentences. While syntactically speaking, sentence-final particles are functions from a sentence to a question or a focused sentence, their categories would not be $S \setminus S_Q$ or $S \setminus S_{foc}$, but rather $S \setminus (S \setminus S)$, which seems to reflect their semantics better.

4.3 CCG of *No*

No can be either a question marker in (10a) and (11a,c) or a polarity (verum) focus marker such as *really* or *indeed* in English, with which the speaker assures the affirmative answer (Höhle 1992, Romero and Han 2004) in (10b) and (11b).

- (10) a. Nani-o shi-teru-no?
what-ACC do-PROG-Q
“What are you doing?”
- b. Hon-o yon-deru-no.
book-ACC read-PROG-FOC
“I am reading a book.”
- (11) a. Hon-o yon-deru-no?
book-ACC read-PROG-Q
“Are you reading a book?”
- b. So. Hon-o yon-deru-no.
yes book-ACC read-PROG-FOC
“Yes, I am reading a book.”
- c. Nani-o yon-deru-no?
what-ACC read-PROG-Q
“What are you reading?”

The CCG tree for *no* as a polarity focus marker in (10b) and (11b) is given in (12). *No* is a question marker in (11a) whose CCG tree is provided in (13). In (12a), *no* has a lexical entry for a polarity focus marker while it is a question marker in (13). The lexical ambiguity of *no* is resolved by rising falling intonation for the polarity focus *no* and the rising intonation for the question marker.

4.4 *Yo* is a Polarity Focus Marker

Kinsui (1993) defines two usages of *yo* as the following:

1. *Kyoji* (teaching/notifying):

A, hankachi-ga ochi-mashi-ta-yo.
oh handkerchief-NOM fall-HON-PAST-FOC
“Oh, you have dropped your handkerchief.”

2. *Chui* (alert):

Omae-wa jukensei-da-yo.
you-TOP entrance-exam-taker-be-FOC

Terebi-o keshite benkyo-shi-nasai.

TV-ACC turn.off study-do-IMP

“You are preparing for an entrance exam. Turn off the TV and study.”

I would like to point out that both usages of *yo* implicates that the hearer is supposed to know that *p* is true. The speaker emphatically demonstrates that s/he wants the hearer to accept the facts—that s/he dropped a handkerchief in (13a) and s/he is before the exam in (13b). With “alerting” *no*, the hearer has believed *p* from before, while the hearer in “teaching/notifying” *no* now believes what s/he had not believed before.

(14) a. Notifying *yo*:

$\neg \text{Past}(\text{Believe}(p)(s)) \wedge \text{Now}(\text{Believe}(p)(s))$

b. Alerting *yo*:

$\text{Past}(\text{Believe}(p)(s)) \wedge \text{Now}(\text{Believe}(p)(s))$

4.5 *Na* as an Exclamative Marker or a Question Marker

According to Masuoka and Takubo (1992), *na* expresses agreement or affirmation. Chino (2001) describes that *na* indicates emotion or asks for agreement. This paper, however, considers *na* as an exclamative marker (15a) or a question marker (15b).

- (15) a. Sugoi ie-da-na.
gorgeous house-be-EXC
“What a gorgeous house!”

(12)

$$\frac{\frac{\frac{\emptyset}{NP_{NOM} : s} \text{ Lex} \quad \frac{\frac{hon-o}{NP_{ACC} : \epsilon x.book'} \text{ Lex} \quad \frac{yonderu}{TVP : \lambda x, y.read(x)(y)} \text{ Lex}}{VP : \lambda y.read'(\epsilon x.book')(y)} \text{ Lex}}{S : read'(\epsilon x.book')(s)} \text{ Lex}}{S \setminus S : \lambda w.\forall w' \in wRw'[read'(\epsilon x.book')(s)(w') = 1]} \text{ Lex} > > \frac{no}{S \setminus (S \setminus S) : \lambda p < st > . \lambda w < s > . \lambda w' \in wRw'[p(w') = 1]} \text{ Lex} <$$

(13)

$$\frac{\frac{\frac{\emptyset}{NP_{NOM} : h} \text{ Lex} \quad \frac{\frac{hon-o}{NP_{ACC} : \epsilon x.book'} \text{ Lex} \quad \frac{yonderu}{TVP : \lambda x, y.read(x)(y)} \text{ Lex}}{VP : \lambda y.read'(\epsilon x.book')(y)} \text{ Lex}}{S : read'(\epsilon x.book')(h)} \text{ Lex}}{S \setminus S : \lambda w < s > . \lambda q < st > [q = read'(\epsilon x.book')(h) \vee q = \neg read'(\epsilon x.book')(h)]} \text{ Lex} > > \frac{no}{S \setminus (S \setminus S) : \lambda p < st > . \lambda w < s > . q < st > [q = p \vee q = \neg p]} \text{ Lex} <$$

(s: speaker, h: hearer)

(w, w': possible worlds, R: epistemic accessibility relation between possible worlds)

(BCCWJ 2009, pn 14475)

- b. Muri-ka-na.
impossible-Q-Q
“Will it be impossible?”

Chino (2001) observes that some kind of *na* softens the effect of an assertion.

- (16) 8-ji-kara 11-ji-da-na.
8-o'clock-from 11-o'clock-be-PAR
“From eight o'clock to 11 o'clock.”

(BCCWJ 2009, oc sentence ID 64)

Such uncertainty expressed by *no* makes us consider this type of *no* as an epistemic modal.

4.6 Sequential Particles: *No-ka*, *Yo-na*, *Yo-ne*

More than one sentence-final particles may appear together although there are restrictions.

- (17) a. So-dat-ta-**no-ka**.
so-be-PAST-PAR-PAR
“Was it so?”
b. Kyo-wa i tenki-da-**yo-na**.
today-TOP good weather-be-PAR-PAR
‘Isn’t it good weather today?’

Given the above categories and semantics, how would two particles combine? Functional composition rule should apply in such cases (Curry and Feys 1958, Steedman 2000).

- (18) a. Forward Composition (>B)
 $A/B \ B/C \rightarrow_B \ A/C$
b. Backward Composition (<B)
 $A \ B \ B \setminus C \rightarrow_B \ A \setminus C$

(19)

$$\frac{\frac{\frac{so}{NP : x} \text{ Lex} \quad \frac{datta}{NP \setminus S : \lambda x.be'(x)} \text{ Lex}}{S : be'(x)} \text{ Lex} < \frac{\frac{no}{S \setminus (S \setminus S) : \lambda p < st > . \lambda w < s > . \lambda q < st > [q = p \vee q = \neg p]} \text{ Lex} \quad \frac{ka}{S \setminus (S \setminus S) : \lambda p < st > . \lambda w < s > . \lambda q < st > [q = p \vee q = \neg p]} \text{ Lex}}{S \setminus S : \lambda w < s > . \lambda q < st > [q = be'(x) \vee q = \neg be'(x)]} \text{ Lex}$$

5. Conclusion

This paper examined the semantics of focus and question and has claimed that syntactic categories of focused sentences and questions should reflect their semantics in adherence of direct compositionality. Such a view should be reflected in CCG analysis of Japanese sentence-final particles some of which were treated as polarity focus markers.

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