Prediction of Japanese Q-Particles

1 A Motivating Question

Consider the following sentence:

"He has (really) (never) (...) gone/*go/*went to Europe."

It may not be surprising to see "gone" after the occurrence of "has".
But, when you see "has", do you predict something upcoming?
The claim of some (and myself): **Yes**.

If so:

- What exactly do you predict? ("gone"? past-participle in general?)
- When do you predict it? (when you reach "has", or?)
- How do you predict it? (what knowledge informs your prediction?)

A potential answer to these questions can be given at the level of syntax:

⇒ We predict structures by using structural information and deductions therefrom. (how/what)

⇒ This information is encoded at some trigger point in the input. (when)

But is this the case? Let's test...

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2 Some Japanese Data

In Japanese, wh-phrases must be c-commanded by -ka or -no (a question particle), in the C position.

(1) a. No c-commanding QP → BAD

*Dare-ga [Hanako-ga ringo-o tabeta-ka] tazuneta.
Who-nom Hanako-nom apple-acc ate-Q asked

Intended: Who asked if Hanako ate an apple?

b. (Matrix Wh) Wh is c-commanded by QP → GOOD

Dare-ga [Hanako-ga ringo-o tabeta-ka] tazuneta-no.
Who-nom Hanako-nom apple-acc ate-Q asked-Q

Who asked if Hanako ate an apple?

c. (Embedded Wh) Wh is c-commanded by QP → GOOD

Hanako-ga [Keiko-ga nani-o tabeta-to] itta-no.
Hanako-nom Keiko-nom what-acc ate-Q said-Q

What did Hanako say that Keiko ate?

Two wh-questions (matrix and embedded) can be licensed by a single matrix QP!

(2) Dono gakusei-ga [kyoushi-ga nani-o chuumon-shita-to] kuwashi-ku tazunemashita-ka
Which student-nom teacher-nom what-acc order-did-dec in-detail asked-Q
Which student asked what the teacher ordered in detail?

Example 2 presents an ambiguity to the parser.

"Dono gakusei-ga kyoushi-ga nani-o..." → is it 1 or 2 QPs coming?

chuumon-shita-to kuwashi-ku tazunemashita-ka"
(Just matrix QP)

chuumon-shita-ka kuwashi-ku tazunemashita-ka"
(Both matrix and embedded QP)

We can use this ambiguity to test for prediction.

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3 An Experiment

Using the data from above we can make an experiment to test for predictive effects. Assume the following conditions and an example item. Wh quetions and QPs are highlighted red.

		F1	
		1QP	2QP
F2	Dono (Which)	Cond. A	Cond. B
	Sono (That)	Cond. C	Cond. D

Table 1: Conditions for Experiment

(3) a. Dono gakusei-ga [kyoushi-ga nani-o chuumon-shita-to] kuwashi-ku tazunemashita-ka
Which student-nom teacher-nom what-acc order-did-dec in-detail asked-Q
Which student asked what the teacher ordered in detail?

b. Dono gakusei-ga [kyoushi-ga nani-o chuumon-shita-ka] kuwashi-ku tazunemashita-ka
Which student-nom teacher-nom what-acc order-did-Q in-detail asked-Q
Which student asked what the teacher ordered in detail?

c. Sono gakusei-ga [kyoushi-ga nani-o chuumon-shita-to] kuwashi-ku tazunemashita-ka
That student-nom teacher-nom what-acc order-did-dec in-detail asked-Q
What did that student ask in detail that the teacher ate?

d. Sono gakusei-ga [kyoushi-ga nani-o chuumon-shita-ka] kuwashi-ku tazunemashita-ka
That student-nom teacher-nom what-acc order-did-Q in-detail asked-Q
What did that student ask in detail that the teacher ate?

Hypothesis: The human sentence processor is structurally predictive.

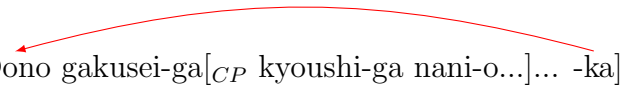
- When? → Upon reaching each Wh (dono, nani-o)
- What? → An upcoming QP in the first possible C position
- How? → Employing (structural) knowledge that Wh questions are licensed by c-commanding QP in C position

4 Expected Results

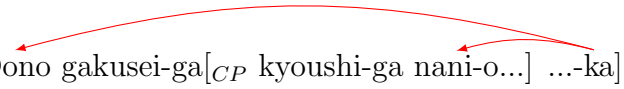
Under the predictive hypothesis, we expect some things to happen for conditions A and B.

1. Matrix "Dono" triggers prediction of upcoming QP in Matrix C position.

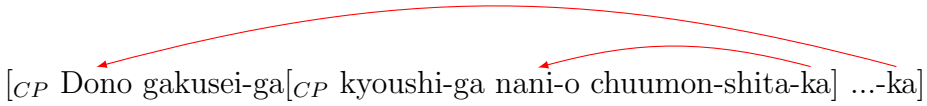
2. Embedded "nani-o" triggers prediction of upcoming QP in (some) C position.



3. Given the QP predicted by "Dono", the least effort is to assume nani-o "covered" by matrix QP. This is the case of condition A.



4. If an embedded QP appears, we should observe slowdown at that point. This is the case of condition B.



In condition B, a second (embedded) QP shows up.
We should observe a significant slowdown at that point compared to A.

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5 Why Important?

Showing significant slowdown at the embedded QP in Condition B is in accordance with our predictive hypothesis.

What would other hypotheses say about the reading time at the embedded QP?

- Integration: No slowdown is anticipated since the embedded QP should fit very well into the context of a nearby Wh which it can license.
- Others?

This experiment can successfully separate the predictions of these differing hypotheses. This experimental framework can be used in other studies to disambiguate competing theories of prediction, integration, etc. This has implications for theoretical space of possible parsers (i.e., what capabilities the parser should have).