Topicality in the Semantics and Pragmatics of Questions and Answers: Evidence for a File-Like Structure of Information States

Katsuhiko Yabushita
Department of English
Naruto University of Education
yabuchan@naruto-u.ac.jp

Abstract

In the literature of the semantics and pragmatics of questions and answers, little attention has been paid to topicality in stark contrast to focus. In this work, we will examine a phenomenon from Japanese that strongly suggests the relevance of topicality, and propose a formal analysis in a dynamic-semantic framework, "Extended File Change Semantics" developed by Portner and Yabushita (1998) for the treatment of topic phrases. Then, we will consider its empirical and theoretical implications. Specifically, we will argue that the success of the proposed analysis gives evidence for the thesis that information structures have a file-like structure being segmented for each discourse referent and the update by an utterance in general is a local operation with its effects being restricted primarily to the segment, or file-card for an discourse referent which the discourse is "about". Furthermore, we will discuss the issue whether the alleged relevance of topicality attested by Japanese, which has an explicit topic marker, is motivated also for languages that do not have an explicit topic marker, using data from English.

1 Relevance of Topicality for Semantics and Pragmatics of Questions and Answers: Data from Japanese

First, consider the following question-answer dialogue in Japanese, which has an explicit marker for a topic phrase, i.e. *-wa*:

(1)
Q. Dare ga hashitte
who Nom running

imasu ka.
be Q
'Who is running?'

A1. Jon ga hashitte imasu.
John Nom running be
'John is the one who is running./Only John is running.'

A2. #Jon wa hashitte imasu.
John Top running be
'As for John, he is running.'

What is to be noted here is the difference between (1A1) and (1A2) in interpretation as answers to (1Q). First, (1A1) and (1A2) are minimally different from each other in that the subject, *John* is nominative-marked in (1A1), while it is topic-marked in (1A2). Interpreted out of context, there are no truth-conditional differences between (1A1) and (1A2); both of them are true if and only John is running. Interpreted as

answers to (1Q), however, there are truth-conditional differences between them. As the glosses indicate, (1A1) implies that only John is running, which is considered an instance of 'exhaustiveness' (Groenendijk and Stokhof 1982, 1984, 1990). On the other hand, (1A2) commits itself only to the truth of John's running, staying away from the issue whether the other relevant people are running or not. A word is in order about (A2) being #-marked. The sharp sign indicates that (A2) is not as felicitous or "congruent" an answer to (1Q) as (A1); (A2) does not strike one as straight an answer as (A1), giving the impression that you are withholding some information relevant to the question under consideration, or sidestepping the issue.

We take the above interpretational phenomena to imply among others, the following facts about topicality in relation to the semantics and pragmatics of questions and answers:

(2) a. Topicality has some semantic or truth-conditional significance.[1]

b. Topicality is relevant in the semantics and pragmatics of questions and answers, at least with respect to exhaustiveness.

2 Formal Analysis

In the following, we will propose a formal analysis of the phenomenon that does justice to the observations in (2), and discuss its implications for the interpretation of dialogue, especially with respect to the structure of information states and how they get updated.

2.1 Extended File Change Semantics

As the semantic framework in which the analysis to be proposed will be couched, we adopt the one that was developed by Portner and Yabushita (1998) for a semantic treatment of topicality, called "Extended File Change Semantics". As the name suggests, the framework was an extension of File Change Semantics proposed by Heim (1982: Chapter 3) for an analysis of the semantics of (in)definite noun phrases and nominal anaphora. Portner and Yabushita extended it for a semantic treatment of topic phrases in that information states (Portner and Yabushita call them "common grounds") are constructed to have a file-like structure in having a file card, or segment for each discourse referent. In the setting, the topic phrase of a sentence was analyzed as a pointer of a discourse referent whose file card is to be selectively updated by the propositional content of the sentence, along with the so-called "aboutness condition" approach to topicality (cf. Vallduví 1990).

Here, let us review Extended File Change Semantics to the extent that it is essential to understand the following discussion. Therein, an information state ('file' in Heim 1982, 'common ground' in Portner and Yabushita 1998) is defined to be a set of infinite sequences of pairs, where each pair consists of an entity and a set of possible worlds. Suppose A is an element of an information state, i.e. an infinite sequence of pairs of entities and sets of possible worlds. Intuitively, the *i*th pair denoted $<e_{i, A}, I_{i, A}>$ represents a discourse referent numbered *i*; $e_{i, A}$ is a possible value for the discourse referent *i*, and $I_{i, A}$ is propositional information having been attributed to the discourse referent so far in the discourse. With an information state having a segment for each discourse referent, the update function for a formula can be specified to selectively update the segment designated for a particular discourse referent, as in (3). There the updating function is denoted $+_k$, with index *k* indicating that the file card for discourse referent *k* is to be updated, an information state is denoted CG (common ground) following Portner & Yabushita, and for an expression α, Int(α) is the intension of α.

(3) For an information state CG, an *n*-place predicate R ($n \geq 1$), and variables $x_i, \ldots, x_j$,
$CG +_k R(x_i, \ldots, x_j) =$
$\{A \in CG :$ for every $w \in I_{k, A}$,
$< e_{i, A}, \ldots, e_{j, A} > \in Int(R)(w)\}$.

Using the (indexed) update function, the topic phrase of a sentence can be analyzed in terms of information-state update as directing which discourse referent's segment is to be updated with the propositional content of the sentence, as in (4).

[1] For more evidence for the semantic or truth-conditional significance of topic phrases other than the data in (1), see (Portner and Yabushita, 1998).

(4) For any information state CG, and any sentence of the logical form [T_i, ϕ], where T_i is a topical discourse referent *i* and ϕ is a formula for the sentence,
CG + [T_i, ϕ] = CG +$_i$ ϕ.

2.2 Extension of Extended File Change Semantics for the Treatment of Questions and Answers

Now that the basic features of Extended File Change Semantics have been reviewed, we will present an analysis of questions and answers as we extend the framework by adding necessary features specific to questions and answers. First, logical forms will be enriched to incorporate focus structure along with the structured-meaning approach to focus (von Stechow 1989, Krifka 1991), according to which the logical form of a sentence in general has a binary structure <B, F>, where B is the background part and F is the focus part. Given a sentence S with a focused constituent A with their "ordinary" logical forms ϕ and α, respectively, the structured-meaning logical form of the sentence will be <λX.ϕ[α/X], α>, where ϕ[α/X] is the result of replacing α in ϕ with an appropriate variable X. On the assumption that a WH-phrase is inherently focused (Rooth 1985 among others), a WH-sentence will have a logical form of the background-part form. The logical form actually coincides with the 'relational' meaning of a question on the "categorial" approach to questions and what Groenendijk and Stokhof (1982, 1984, 1990) called the "(*n*-place) abstract". We adopt the background-focus form logical form augmented with the topic structure abstracting over the focus part as the meaning of a WH-question because of fact (2b). That is, a WH-question will now have a logical form of the form of λY[T_i, <B, Y>], with the focus part being abstracted, called "focus abstract". For example, question (5a) will be considered to have the logical form as in (5b), and a possible, congruent answer to (5a), e.g. (6a) will be considered to have the logical form as in (6b).

(5)

a. Jon_1 wa dare o
John Top who(m) Acc
aishite-imasu ka.
love Q
'Who(m) does John love?'

b. λY[$John_1$, <λX.LOVE($John_1$, X), Y>]

(6)

a. Jon_1 wa $Meari_2$ o
John Top Mary Acc
aishite-imasu.
love
'John loves Mary.'

b. [$John_1$, <λX.LOVE($John_1$, X), $Mary_2$>]

With formulas of the background-focus structure now introduced, it is necessary to define the (index) updating of an information state with so structured a formula. It is defined as follows:

(7) CG +$_i$ <B, F> = CG +$_i$ B(F), where B is an expression of the form λX.ϕ and B(F) is the result of substituting F for every occurrence of X in ϕ.

What about the logical forms of (1Q), (1A1), and (1A2), which prompted the current discussion in the first place? The obvious problem with (1Q) and (1A1) is that they do not have a topic phrase present. Here, we assume that some contextually determined situation is the topic for (1Q) and (1A1); furthermore, the situation occurs as an argument of the predicate in question (Davidson 1967, Kratzer 1988/1995). That is, the logical forms of (1Q), (1A1), and (1A2) are considered something as in (1Q)′, (1A1)′, and (1A2)′, respectively.

(1Q)′ λY[s_3, <λX.RUNNING(s_3, X), Y>]

(1A1)′ [s_3, <λX.RUNNING(s_3, X), $John_1$>]

(1A2)′ [$John_1$, < $John_1$, λX.RUNNING(s_3, X)>]

With the logical forms of the relevant sentences determined, let us proceed to the interpretation of questions and answers and an analysis of exhaustiveness. We take answering to be an illocutionary act of assertion in the environment

of a question, which is interpreted to be a (partial) function from information states to information states. In this setting, exhaustiveness will be analyzed as a conversational implicature arising from an (optional) operation on the information state resulted from updating by answering. Schematically, the current analysis of answering a question and exhaustiveness can be represented by the following diagram:

(8)
<common ground CG, question Q, answer A>
|
|←illocutionary act of answering (ANSWER)
|
<common ground CG′, question Q >
|
|←exhaustivization (EXHAUST) (optional)
|
common ground CG″

Diagram 1: Interpretation Schema of Answering Optionally Followed by Exhaustivization

The operation of ANSWER is defined as follows:

(9) ANSWER(CG, Q: $\lambda Y[T^q, <B^q, Y>]$, A: $[T^1, <B^1, F^1>], \ldots, [T^n, <B^n, F^n>]$)
maps a common ground CG to a common ground CG′ such that
CG′ = CG + A: $[T^1, <B^1, F^1>], \ldots, [T^n, <B^n, F^n>]$ on the following felicity condition among others: The question and the answer sentence(s) have the same topic and the background parts, i.e. $T^q = T^1 = \ldots = T^n$ and $B^q = B^1 = \ldots = B^n$.

What ANSWER does is basically to update a common ground CG in such a way that for every $A \in CG$, the information segment for the topical discourse referent, say *k*, i.e. $I_{k, A}$ should entail the propositional content of the (the conjunction of) the answer sentence(s).

Next, we go on to the definition of the exhaustivization operation, EXHAUST. It is an operation on an information state resulted from the operation of ANSWER, as is indicated in Diagram 1. Before we go into the formal definition of EXHAUST, it will be expositional to outline what EXHAUST does first so that we will not be bogged down in the details involved.

Suppose CG´ is an information state resulted from the application of ANSWER to some information state CG in the environment of a question Q and some answer sentence(s). The operation of EXHAUST will modify CG´ modulo Q: $\lambda Y[T^q, <B^q, Y>]$ into an information state CG″, which is minimally different from CG´ in that for every $A \in CG''$, for the topic discourse referent, say *k* (= T^q), every possible world $w \in I_{k, A}$ is such that the extension of $\lambda Y[T^q, <B^q, Y>]$ in w contains only the individuals 'minimally' warranted by the answer sentence(s); in other words, w is "minimal" in $I_{k, A'}$ for some $A' \in CG'$ with respect to the extension of B^q.

Here, let us illustrate what we mean by "the individuals 'minimally' warranted by the answer sentence(s)". Consider the following examples of question-answer dialogue.

(10) Q. Who came to see Mary?

A1. John did.
A2. A man did.
A3. Siskel or Ebert did.

As answers to (10Q), (10A1), (10A2), and (10A3) are normally interpreted exhaustively that only John came to see Mary, that one man and only one man did, and that either Siskel or Ebert, but not both did, respectively. Those interpretations all can be characterized as those in which the extension of the predicate in question 'came to see Mary' is specified to be a minimal set containing the individual(s) the answer asserts to have come to see Mary.

In terms of the current view of interpretation as a process of information-state updating, exhaustivization will be analyzed as pragmatically induced, optional updating to be applied post to the initial updating by the literal content of the answer sentence(s). (See Diagram 1.)

For the formal definition of EXHAUST, we need a couple of auxiliary notions to be defined. First, we need to determine the extension of a focus abstract as the meaning of an interrogative.

(11) Definition (Extension of a Focus Abstract)

Given a focus abstract Ψ of the form $\lambda Y[T_i, <B, Y>]$, a model M, a possible world w, a common ground CG, and an index $j \notin Dom(CG)$, the extension of Ψ with respect to M, w, and CG, denoted $|\Psi|^{M, w, CG}$ is defined as follows:
$|\Psi|^{M, w, CG}$
$= \{e_{A, j}: A \in CG + \Psi(j) \& w \in I_{A, i}\}$.

Based on the extension of a focus abstract Ψ of the form $\lambda Y[T_i, <B, Y>]$ with respect to a model M, a possible world w, and a common ground CG, we will define a partial order on $I_{i, A}$ for $A \in CG$, denoted $\leq_{\Psi, CG}$.

(12) Definition ($w \leq_{\Psi, CG} w'$)

Given a Topic-Background abstract Ψ of the form $\lambda Y[T_i, <B, Y>]$, a common ground CG, a sequence $A \in CG$, for any two possible worlds, w and $w' \in I_{i, A}$,
$w \leq_{\Psi, CG} w'$
if and only if $|\Psi|^{M, w, CG} \subseteq |\Psi|^{M, w', CG}$.

Given a set of possible worlds ordered with respect to the partial order just defined, the "minimal" elements of the set can be defined as follows:

(13) Definition ("Minimal" Possible Worlds)

Given a Topic-Background abstract Ψ of the form $\lambda Y[T_i, <B, Y>]$, a common ground CG and a sequence $A \in CG$, let $<I_{i, A}, \leq_{\Psi, CG}>$ be $I_{i, A}$ with the partial order $\leq_{\Psi, CG}$. Then, $w \in I_{i, A}$ is a minimal element of $I_{i, A}$ if and only if for any $w' \in I_{i, A}$, $w' \leq_{\Psi, CG} w$ implies $w' = w$.

With all the necessary auxiliary notions having been defined, we can finally go on to the formal definition of EXHAUST, which is as follows:

(14) Definition (EXHAUST)

Let CG´ be an information state resulted from answering to a question whose focus abstract is Ψ with an answer sentence(s) on an input information state CG, i.e. CG´ = ANSWER(CG, Ψ, A), which is CG + $[T^1, <B^1, F^1>]$, $[T^2, <B, F>]$, …, $[T^n, <B, F>]$. When the answer A is uttered with some linguistic signal indicating that the utterance is complete such as the falling tone in English, and there is no expression to explicitly defy an exhaustive reading, CG´ is subjected to the following operation EXHAUST.

EXHAUST(CG´, Ψ)
$= \{A': A \in CG' \& A'$ is exactly like A except that $I_{i, A'} = \{w: w$ is minimal in $< I_{i, A}, \leq_{\Psi, CG'}>\}\}$.

2.3 The Current Analysis' Account of the Data

In the above we have presented a semantic and pragmatic analysis of questions and answers incorporating topicality, which has been shown to be relevant to the semantics and pragmatics of questions and answers. It is time to see how the current analysis fares well with the data introduced at the outset, specifically the interpretational facts surrounding the question-answer dialogues: (1Q)-(1A1) and (1Q)-(1A2). The sentences, (1Q), (1A1), and (1A2) will be reproduced here along with their information-structural logical forms, (1Q)´, (1A1)´, and (1A2)´, respectively.

(1Q) Dare ga hashitte
who Nom running

imasu ka.
be Q
'Who is running?'

(1Q)´ $\lambda Y[s_3, <\lambda X.RUNNING(s_3, X), Y>]$

(1A1) Jon ga hashitte imasu.
John Nom running be
'John is the one who is running./Only John is running.'

(1A1)´ $[s_3, <\lambda X.RUNNING(s_3, X), John_1>]$

(1A2) #Jon wa hashitte imasu.
John Top running be
'As for John, he is running.'

(1A2)′ [$John_1$, < $John_1$, λX.RUNNING(s_3, X)>]

Now let us see how the interpretation of (1A1) as an answer to (1Q) is analyzed. The felicity condition for ANSWER in (9) is satisfied as their topic parts and background parts coincide with each other. Then the answering operation proceeds to update a given CG to CG_{A1}′ as in (15).

(15) ANSWER(CG, (1Q)′, (1A1)′)
= CG + (1A1)′ = CG + [$John_1$, < $John_1$, λX.RUNNING(s_3, X)>] = CG_{A1}′
= {A ∈ CG : for every w ∈ $I_{3, A}$, John is running in the situation 3 in w}.

CG_{A1}′, then, will undergo the exhaustivization operation, i.e. EXHAUST(CG_{A1}′, (1Q)′), and will be modified into CG_{A1}″ as in (16).

(16) EXHAUST(CG_{A1}′, (1Q)′) = CG_{A1}″ =
{A′: A ∈ CG_{A1}′ & A′ is exactly like A except that $I_{3, A'}$ = {w: w is minimal with in < $I_{3\,A}$, $\leq_{(1Q)', CG_{A1}'}$>}}.

As for every A ∈ CG_{A1}′, for every w ∈ $I_{3\,A}$, w is such that the extension of (1Q)′ contains at least John, a possible world w is minimal in < $I_{3\ A}$, $\leq_{(1Q)', CG_{A1}'}$> when the extension of (1Q)′ at w contains only John. Therefore, the resulted information state, CG_{A1}″ can be expressed in more plain language as in (17).

(17) EXHAUST(CG_{A1}′, (1Q)′) = CG_{A1}″ =
{A ∈ CG_{A1}′, for every w ∈ $I_{3, A,}$ the extension of running in the situation 3 in w contains only John, or equivalently, only John is running in the situation 3 in w}.

We have seen that answering (1Q) with (1A1) felicitously updates an information state and the resulted information state is further modified to one such that (the segment "about" the situation 3 of) it entails that only John is running (exhaustiveness), which coincides with the empirical data. Next, let us see the case of answering (1Q) with (1A2)? The felicity condition for the answering operation is not satisfied as neither the topic parts nor the background parts of (1Q)′ and (1A2)′ coincide with each other. In terms of topic, (1Q) is "about" the situation 3, while (1A2) is "about" John, and in terms of focus, (1Q) focuses on who is running in the situation 3, while (1A2) focuses on what John is doing in the situation 3. We claim that these discrepancies between (1Q) and (1A2) are responsible for the infelicity of (1A2) as an answer to (1Q). Coerced to be interpreted despite the violation of the felicity condition, (1A2) would update a given information state CG to CG_{A2}′ as in (18).

(18) ANSWER(CG, (1Q)′, (1A2)′)
= CG + (1A2)′ = CG + [$John_1$, < $John_1$, λX.RUNNING(s_3, X)>] = CG_{A2}′
= {A ∈ CG : for every w ∈ $I_{1, A}$, $John_1$ is running in the situation 3 in w}.

As is shown in (18), (1A2) would update the segment "about" John with respect to what he is doing when question (1Q) is "about" the situation 3 and solicits information about who is running in the situation. This, we claim, coincides with the fact that (1A2) as an answer to (1Q) gives the impression that it is "sidestepping the issue". As for exhaustiveness, the exhaustiveness operation would not affect the segment "about" John, which has been updated by (1A2) because the operation was defined to affect the segment about the topic of the question, in this case, that of the situation 3. Consequently, the segment "about" John remains to entail that John is running, no more or no less, which accounts for the absence of exhaustiveness from (1A2).

3 Cross-Linguistic Considerations: Is Topicality Universally Relevant to Semantics and Pragmatics of Questions and Answers?

The current analysis of the semantics and pragmatics of questions and answers in relation to topicality is essentially based on the data from Japanese, which has an explicit morphological marker for topic phrase. The questions that might occur to the reader naturally at this point include among others the following. Is the current analysis relevant to the cases of other languages, especially those that have no explicit

topic marker? Isn't the background-focus structure sufficient for an analysis of the data in question? In other words, is it necessary to bring in topicality into the picture?

For those questions, let us consider the following examples of English question-answer dialogue, where there is a phonological prominence, or sentential stress on the capitalized phrases.

(19) Q. Who is running?

A1. JOHN is running.
A2. #John is RUNNING.

This set of examples is a perfect reflex of that in (1) in that (19A1) is interpreted to mean that only John is running as (1A1) is, and that (19A2) is infelicitous as an answer to (19Q) giving the impression that your are "sidestepping the issue" as (1A2) is to (1Q) and if coerced to be interpreted, (19A2) could only be interpreted non-exhaustively, i.e., that John is running with no implications as to whether the other people are running or not.

On the assumption that a WH-phrase is inherently focused and the phonological prominence is a focus marker in English; in (19A1) and (19A2), the subject *John* and the predicate *is running* are considered to be focused, respectively, the background-focus structures of (19Q), (19A1), and (19A2) will be as in (19Q)´, (19A1)´, and (19A2)´, respectively.

(19Q)´ $\lambda Y[<\lambda X.\mathrm{RUNNING}(s_3, X), Y>$

(19A1)´ $<\lambda X.\mathrm{RUNNING}(s_3, X), \mathrm{John}_1>$

(19A2)´ $< \mathrm{John}_1, \lambda X.\mathrm{RUNNING}(s_3, X)>$

It is observed that in the case of an felicitous question-answer dialogue, i.e. (19Q)-(19A1), their background parts are identical, while in an infelicitous case, i.e. (19Q)-(19A2), the background parts are distinct. In light of the observation, we could propose the following felicity condition for questions and answers, which is weaker than that in (9), not requiring the identity in the topic part.[2]

(20) Given a question and an answer with their background-focus structures, Q: $\lambda Y<B^q, Y>$, A: $<B^1, F^1>, \ldots, <B^n, F^n>$, Q and A are a felicitous question-answer pair only if the background of the question and that of the answer are identical, i.e., $B^q = B^1 = \ldots = B^n$.

With the condition above, which is free from reference to topicality, we can explain the felicity facts of (19). As for the exhaustive vs. non-exhaustive difference in reading between (19A1) and (19A2). One might propose an account like the following. As an infelicitous answer, (19A2) does not quality for the exhaustivization operation, which is applicable only to felicitous answers; therefore, the reading available to (19A2) on a coerced interpretation would be at most the one of the literal meaning, in this case, the non-exhaustive reading.

With the putative success of the above topicality-free account of the semantic and pragmatic facts of (19), one might argue that the same account should be applicable to the Japanese data in (1) as well; therefore, the relevance of topicality will be in doubt.

For such a contention, we would like to present the following question-answer example.

(21) Q. Who(m) did John introduce Mary to?

A1. John introduced Mary to BILL.
A2. #Mary was introduced to BILL by John.

What is to be noted here is that as the sharp sign indicates, (21A2) is not felicitous as an answer to (21Q) unlike (21A1).

If the background-focus structure were a sufficient articulation for logical forms of questions and answers, (21A1) and (21A2) should not show any differences in felicity as answers to (21Q), for (21A1) and (21A2) are considered to have the same background-focus structure. Actually, however, they do as we have noted above. On the other hand, the felicity facts in question are not a problem to our current analysis, which adopts a more articulated structure for logical forms. On the widely accepted assumption that the subject is a default position for a topic phrase in English, the logical forms of (21Q), (21A1),

[2] Conditions of the same effects have been proposed in e.g. (Yabushita, 1991, 1992), (Rooth, 1992), and (Krifka, 1999).

and (21A2) will be something as in (21Q)´, (21A1)´, and (21A2)´, respectively.

(21Q)´ λY[$John_1$, <λX.INTRODUCED(s_3, $John_1$, $Mary_2$, X), Y>]
(21A1)´ [$John_1$, <λX.INTRODUCED(s_3, $John_1$, $Mary_2$, X), $Bill_4$>]
(21A2)´ [$Mary_1$, <λX.INTRODUCED(s_3, $John_1$, $Mary_2$, X), $Bill_4$>]

Then, the current analysis, specifically, the specification of the ANSWER operation correctly predicts that (21A2) will not be felicitous as an answer to (21Q) as they do not have an identical topic-background structure, while (21A1) and (21Q) do. We take what has been seen above to be evidence that topicality is crucially involved in the semantics and pragmatics of questions and semantics even in languages that have no explicit topic-marker like English.

4 Conclusion

We have presented a phenomenon from Japanese, i.e. data in (1) as evidence for the relevance of topicality to the semantics and pragmatics of questions and answers, and have proposed a formal analysis couched in Extended File Change Semantics, which was developed by Portner and Yabushita (1998) for the treatment of topic phrases. We take the success of the analysis to imply the legitimacy of the framework with regards to the structure of information states and the mode of updating information states by utterances.

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