Rhetorical wh-questions differing in inquisitiveness: Support from Mandarin prosody[1]

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Abstract. Rhetorical questions are in many respects both question-like and assertion-like, and have been analyzed either as questions or assertions. Building on Farkas and Roelofsen (2017), we propose a unified account of rhetorical and information-seeking wh-questions in inquisitive semantics, where we are no longer forced to choose between these labels. Rhetorical questions that suggest that the answer is the empty set ('nobody' to a question with *who*) are compared to ones that suggest a non-empty set as their answer. We assign the same basic conventional discourse effects to the two types of rhetorical questions as for information-seeking questions, but posit different special discourse effects, which signal differences in speaker commitment. Special effects are signaled by a marked form, such as by a non-canonical intonation. We argue that the prosodic marking of Mandarin wh-interrogatives, whether used as a genuine or rhetorical question, is consistent with our analysis.

Keywords: rhetorical questions, wh-interrogatives, inquisitive semantics, commitment, prosody, Mandarin, sentence-final particles

1. What are rhetorical questions?

Rhetorical questions (RQs) are questions that do not require an answer and which function as assertions, in many respects. There are two influential analyses of RQs. According to one, they are equivalent to an assertion of the answer being the empty set (Han, 2002). That is, if the interrogative *Who likes salty licorice?* is used as a RQ, it is equivalent to asserting 'Nobody likes salty licorice', as in (1a). But RQs can also be defined as questions with an obvious answer (Rohde, 2006; Caponigro and Sprouse, 2007; Biezma and Rawlins, 2017; Jamieson, 2018); such a definition would acknowledge uses where the answer suggested by the RQ is a non-empty set.[2]

(1) a. Context: You and Ann are in a shop looking for ice-cream. There are barely any flavours left but you see that there is plenty of salty licorice flavoured ice-cream. You say to Ann: No wonder these are still available. *Who likes salty licorice?*
b. Context: You receive a large package of salty licorice. Your kids are wondering who it is for, although you all know that your partner is the only one in the family who likes it. You say: Oh come on! *Who likes salty licorice?*

We label an RQ with an empty set answer like (1a) as "RQ−", and an RQ with a non-empty set answer like (1b) as "RQ+". A genuine or information-seeking questions is abbreviated as "ISQ".

Both approaches grasp essential properties of RQs. The negated assertion-like analysis of Han

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[2]For simplicity, we only treat singleton answers, although multiple answers are also possible; see Rohde (2006).

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(2002) proposes that the wh-word turns into a "negative quantifier" whereby the licensing of negative polarity items is explained; however, this analysis has nothing to say about RQ+s. Even if we restrict Han's analysis to RQ−s only, it still cannot explain why RQs can be answered, as pointed out by Caponigro and Sprouse (2007). Question-like analyses, on the other hand, apply to both RQ−s and RQ+s (Rohde, 2006; Caponigro and Sprouse, 2007; Biezma and Rawlins, 2017; Jamieson, 2018); at the same time, they cannot explain asymmetries in form and meaning found between RQ−s and RQ+s when reporting her claims.

We continue this section by describing basic properties of RQs accounted for by the two main analyses and show that neither of them alone can fully account for relevant properties of RQs. In section 2, we briefly introduce Farkas and Roelofsen's (2017) inquisitive semantic model of declarative and interrogative sentences, and in section 3 we propose an extension to it which accommodates wh-interrogatives, including rhetorical wh-questions. In section 4 we show a summary of a production experiment on Mandarin wh-interrogatives which we interpret as a support for our theoretical claims. We mention some important remaining issues in section 5 and conclude the paper in section 6.

1.1. Rhetorical questions as negated assertions

Han (1998, 2002), building on the observations of Sadock (1974), pictures RQs as utterances that start out as questions, but at some point in the derivation, they turn into negated assertions. Although they refer to them as "rhetorical questions", they only consider RQ−s. However, some of those claims apply to both RQ−s and RQ+s, so I adhere to referring to "RQs".

One argument for considering RQs as assertions comes from their compatibility with pragmatic markers such as *after all* or *yet*. Han's (2002) examples, (2a) and (2c), show that these markers are felicitous in RQs, as the corresponding assertions, (2b) and (2d), readily host them, too.

(2) a. *After all*, do phonemes have anything to do with language? (Han, 2002)
b. *After all*, phonemes do not have anything to do with language.
c. Do phonemes have anything to do with language? *Yet* people continue to believe in them. (Han, 2002)
d. Phonemes do not have anything to do with language, *yet* people continue to believe in them.

The assertion-like nature of RQs is also shown by the fact that they can serve as answers themselves, which Schaffer (2005) calls *rhetorical-questions-as-retorts*.

(3) a. A: Does Ed McMahon drink?
B: Is the Pope a Catholic?
b. A: How do you like school?
B: How do you like prison? (Schaffer, 2005)

In (3a), the suggested answer to A's question is the obvious answer to B's question: 'yes'. And B's answer in (3b) is that B likes school to the extent one likes prison, that is, not at all.

The assertion-like analysis of RQ−s receives the strongest support from the distribution of strong negative polarity items or minimizers, such as *lift a finger*, *say a word* or *give a damn* in English. While weak negative polarity items like *anything* or *anybody* (without emphatic

stress), can occur in both ISQs and RQs, it is commonly held that the presence of minimizers necessarily gives rise to a negative bias (Han, 2002; Abels, 2003).

(4) a. When did John (ever) help us? (ISQ or RQ−)
b. When did John *lift a finger* to help us? (RQ− only)

According to Han (2002), the semantic derivation at some point turns RQs into assertions of the "opposite polarity from what is apparently asked". In wh-interrogatives, the wh-word is mapped onto an empty set operator, which is responsible for licensing minimizers. Since the polarity operator in both cases is set to a value, the expression is not a question anymore; it becomes an assertion.

1.2. Rhetorical questions as questions

Proponents of the question-like analysis have revealed a number of weaknesses of the assertion-like analysis. As mentioned before, RQs can have non-null positive answers to them (Caponigro and Sprouse, 2007), as shown by examples (1b) and (3a). This fact is acknowledged by Han (2002) as well. Analyzing only a specific subset of RQs can be misleading, even if this subset consists of the prototypical or most frequent examples of RQs.

Regardless of the fact that RQs have assertion-like properties, question-like analyses of RQs state that they are still formally questions. This is supported by the fact that they can be answered, just like information-seeking questions (ISQs). Although it is possible to react to assertions with response particles, just as to polar questions (cf. Farkas and Bruce 2010), the two utterance types, RQs and assertions, prefer different types of answers, as shown in (5).

(5) a. A: Who likes castor oil? (RQ−)
B: Nobody. / ?/#Yes. / #No.
b. A: Nobody likes castor oil.
B: #Nobody. / Yes. / No.

The two mini-dialogues in (5) are similar because B's utterance in both cases attempts to update the common ground with the same proposition 'nobody likes castor oil'. Yet apparently, they are not subject to the very same contextual restrictions. While RQs may serve as retorts (cf. (3)), they cannot be answers to just any question, the way assertions can (Biezma and Rawlins, 2017). Examples (5) and (6) show that RQs are not equivalent to assertions in every respect.

(6) a. A: Who likes castor oil? (ISQ)
b. B1: Nobody.
B2: #Who likes castor oil? (RQ−)

Even though discourse markers like *after all* group RQs together with assertions, there are other particles which do not. The German modal particle *doch* can occur in declaratives, but not in a RQ−s with the same propositional contribution (Egg, 2013).

(7) a. Es würde doch keiner zu deinem Fest kommen. (German)
'But no one would come to your party.'
b. *Wer würde doch zu deinem Fest kommen? (RQ−)
'But who would come to your party?' (Egg, 2013: (24))

And finally, Caponigro and Sprouse (2007) point out that if RQs are negated assertions, one has to posit two sets of wh-words, which goes against parsimony, but maintaining just one set of wh-words leads naturally to the conclusion that RQs as questions.

Thus we have strong reasons to adopt a question-like analysis of RQs, according to which they are essentially questions with pragmatically derived assertion-like properties (Rohde, 2006; Caponigro and Sprouse, 2007; Biezma and Rawlins, 2017). On this view, it is the obvious answer that all participants already know (and that each participant knows is known by all), and nothing else, that makes a question rhetorical.

As a support for this claim, the authors appeal to the fact that the two kinds of questions are syntactically the same. Nothing in the syntax of (4a) or (5a) signals the difference between the two readings, let alone the context: both can be interpreted as genuine or as rhetorical questions. If RQs and genuine questions are the same both semantically and syntactically, as Caponigro and Sprouse (2007) claim, then we expect there to be both multiple and embedded RQs, just as there are multiple and embedded genuine questions. This is the case, as shown by the multiple RQ in (8a) and the embedded RQ in (8b).

(8) a. You shouldn't be surprised that I punished Pablo rather than Lapo. After all, who hit who first?
b. Should I even ask who would give a damn if I stopped coming to work? (Caponigro and Sprouse, 2007)

Further support for the claim that RQs and ISQs are syntactically the same comes from embedding predicates. If we were to report the RQ in (8b), we would have to choose a predicate that embeds interrogatives such as *ask*

(9) John asked/*claimed who would give a damn if he stopped coming to work.

What makes a question rhetorical in Caponigro and Sprouse's analysis is formulated in (10). A question's denotation is equivalent to a partition on the set of worlds W, where the true answer to it holds in one of the cells of the partition. If a question Q's denotation is an element of the common ground of the speaker and the addressee, that is, if they both know the true answer to Q and they both know this of each other, then Q is interpreted as an RQ. Otherwise, Q is interpreted as an ordinary one (an ISQ in our terms).

(10) a. Q is a Rhetorical Question iff $[\![Q]\!]^w$ is an element of the common ground of both the speaker and the addressee.
b. Q is an Ordinary Question iff $[\![Q]\!]^w$ is not an element of the speaker's beliefs.

Caponigro and Sprouse assume that the denotation of a question is a set of propositions. For example, if Q is a rhetorical question which highlights a certain singleton answer, then the denotation of Q will be p. Assuming that the common ground, too, is a set of propositions, $[\![Q]\!] = p$ has to be a member of it prior to uttering the RQ.

We have shown a number of reasons for analyzing RQs as questions, instead of assertions. However, most of them overlook the fact that RQ−s and RQ+s do show an asymmetry in terms of meaning, as pointed out by Jamieson (2018). Jamieson proposes that wh-RQ−s suggest a generic answer; on this reading, the answer to (1a), the RQ− "Who likes salty licorice?" is not just 'nobody in the contextually given domain' but rather, 'nobody on earth'. RQ−s widen

the contextual domain to the largest possible extent, which is due to a metavariable ε, which ranges over entities outside the canonical domain denoted by the wh-phrase. At the same time, Jamieson calls RQ+s as 'pragmatic' RQs, treating them as ISQs, to which the answer is contextually given.

In agreement with Jamieson, we acknowledge that RQs are not a homogeneous group in terms of their effects on the context. First, minimizers are licensed only in RQ−s, not in RQ+s, and second, our earlier work on the prosody of RQ−s and RQ+s in Chinese languages shows that the two types of RQs are prosodically distinguished from each other and from ISQs (Lo et al., 2019; Lo and Kiss, 2020). We argue that this asymmetry follows from differences in the special discourse effects of RQ−s and RQ+s. We formulate this using Farkas and Roelofsen's (2017) inquisitive semantic framework, which allows us to account for the insights of both the assertion-like and the question-like analyses. Inquisitive semantics, which posits that meaning is not dichotomous, makes it possible to do so in a parsimonious way (i.e., without reference to speech act operators or metavariables).

2. Farkas and Roelofsen's (2017) *Division of Labor* model

In this section, we briefly present the framework of Farkas and Roelofsen's (2017), which we then extend to accommodate wh-interrogatives.

2.1. Basic notions

Propositions are generally modeled as sets of possible worlds; when a speaker x commits to a proposition p, all possible worlds not compatible with p are discarded from x's *commitment set* (cs_x), that is the set of the possible worlds compatible with all of x's commitments (Stalnaker, 1978). The set of possible worlds that are compatible with p represent its informative content. In inquisitive semantics however, a proposition P also has *inquisitive content*, expressing its "potential to raise an issue". Issues are modeled as sets of *information states*, such that each information state supports a possible answer to the issue.

(11) A proposition P is a non-empty, downward closed set of information states
   a. Inquisitive content: the issue embodied by P, resolved in a state s iff $s \in P$
   b. Informative content: For any proposition P, info(P) := $\bigcup P$

An information state s can have substates t such that every possible world in t is also present in s, that is, $t \subseteq s$. For example, if an information state s supports the possibility *Ann likes salty licorice*, it will also support its substate t *Ann likes salty licorice and Ben likes salty licorice*.

Information states form lattices, the maximal element of which are referred to as *alternatives*.[3] An inquisitive proposition consists of at least two alternatives. In polar questions, one alternative corresponds to the proposition conveyed by the sentence radical, and the other one, to its negation. The alternative that is denoted by the sentence radical has a distinguished status as it introduces a propositional discourse referent; it is therefore called the *highlighted alternative*.

The *inquisitive content* of a proposition P, or the issue it raises, is embodied by a set of infor-

[3] A downward pointing arrow is used as a reminder that substates are included: $\{\alpha\}^{\downarrow}$.

mation states, such that each information state could potentially resolve the issue embodied by P. A proposition P is inquisitive if it consists of more than one state and hence the informative content of P is not an element of P, cf. (12a).

The *informative content* of a proposition P in inquisitive semantics is a set of possible worlds: $\text{info}(P) \subseteq W$, that is, the union of every world w such that $w \in s$, such that $s \in P$. A proposition is informative if its informative content is a proper subset of the set of all possible worlds W. If the informative content of a proposition equals W, it is no longer informative, because it does not rule out any world, and hence leaves an ignorant epistemic state untouched.

(12) Informative and inquisitive propositions
   a. A proposition P is inquisitive iff $\text{info}(P) \notin P$
   b. A proposition P is informative iff $\text{info}(P) \neq W$ (Ciardelli et al., 2018: 23)

The basic *discourse context* proposed by Farkas and Roelofsen keeps track of the participants, the table, and the commitment sets assigned to each participant, as outlined in (13).

(13) A basic discourse context is a triple ⟨PARTICIPANTS, TABLE, COMMITMENTS⟩, where:
   a. PARTICIPANTS is the set of discourse participants;
   b. TABLE is a stack of propositions, representing the proposals made so far;
   c. COMMITMENTS is a function that maps every participant $x \in$ PARTICIPANTS to a set of possibilities, those possibilities that x is publicly committed to.
   (Farkas and Roelofsen, 2017: 255)

The common ground is the locus of mutual commitments (Stalnaker, 1978; Farkas and Bruce, 2010), which here is derived from the participants' commitment sets.

(14) a. Commitment set: $cs_x = \bigcap \text{COMMITMENTS}(x)$
   b. Common ground: $cg = \bigcup \{cs(x) \mid x \in \text{PARTICIPANTS}\}$
   (Farkas and Roelofsen, 2017: 255)

2.2. Semantic interpretation: Basic conventional and special discourse effects

According to the division of labor principle, both compositionality and conventions of use play a role in interpreting an utterance.

(15) *Division of labor principle*
   a. The discourse effects of unmarked forms should be fully determined by their semantic content and the basic convention of use, F_b.
   b. The discourse effects of marked forms should always include the discourse effects that are dictated by their semantic content and the basic convention of use F_b. In addition, they may include special discourse effects connected to the particular sentence type involved. (Farkas and Roelofsen, 2017: 250)

Expressions of the same sentence radical but different syntactic form (declarative or interrogative) are interpreted by the same principle, and any differences in their interpretation arise from differences in their semantic content. Upon uttering an assertion or a genuine polar question, the context gets updated the following way:

(16) *Basic convention of use*
If a discourse participant x utters a declarative or interrogative sentence ϕ, the discourse context is affected as follows:
a. The proposition expressed by ϕ, $[\![\phi]\!]$, is added to the TABLE.
b. The informative content of ϕ, $\bigcup[\![\phi]\!]$, is added to COMMITMENTS$_x$.
(Farkas and Roelofsen, 2017: 265)

In other words, the inquisitive content of ϕ is added to the TABLE and its informative content, to COMMITMENTS$_x$. In the case of a declarative like *Ann likes salty licorice*, the TABLE is updated by an informative and non-inquisitive proposition P_a, consisting of a single alternative; the polar interrogative with the same sentence radical, *Does Ann like salty licorice?*, places both the highlighted alternative (α) and its complement ($\overline{\alpha}$), on the TABLE, as shown in (18). The speaker's commitments are updated by a set of worlds compatible with the alternative(s) on the TABLE, that is, with α in the case of an assertion, and W for a polar interrogative.

(17) *Conventional discourse effects of participant x uttering a falling declarative expressing the proposition* $\{\alpha\}^{\downarrow}$:
a. $\{\alpha\}^{\downarrow}$ is added to the TABLE
b. α is added to COMMITMENTS$_x$ (Farkas and Roelofsen, 2017: 266)

(18) *Conventional discourse effects of participant x uttering a polar interrogative expressing the proposition* $\{\alpha, \overline{\alpha}\}^{\downarrow}$:
a. $\{\alpha, \overline{\alpha}\}^{\downarrow}$ is added to the TABLE
b. W is added to COMMITMENTS$_x$. (Farkas and Roelofsen 2017: 267)

In marked sentences, special discourse effects may arise in addition to the basic conventional ones. Between any two forms that have the same semantic content, the one that is formally more complex, and therefore "less likely to ensure communicative success" is considered *marked*. Tag interrogatives, having a more complex structure than simple interrogatives, are therefore considered marked. However, the 'form' of the utterance is not entirely defined by the segmental material but also by its suprasegmental properties, most prominently by intonation. One well-known example is rising declaratives or declarative questions, which in English combine a declarative clause with a sentence-final rising tune (Gunlogson, 2003).

Marked sentences are subject to the same basic conventions as unmarked ones, but in addition, they carry extra information that is signaled by their non-minimal form. The extra information, according to Farkas and Roelofsen, concerns the level of credence the speaker has in the truth of the highlighted alternative. The speaker can have high credence, as in the case of uttering an assertion, or low credence, when uttering a rising declarative, or in yet other cases, moderate or zero credence. In English, boundary tones play a crucial role in signalling credence levels.

2.3. Boundary tones

Special discourse effects do not arise arbitrarily, they are inherently tied to intonation. In the cases considered by Farkas and Roelofsen (2017); that is, declarative questions and tag questions in English, sentence-final tunes play a crucial role in determining these special effects.

(19) *The contribution of sentence-final tunes to the special discourse effects of utterances*

a. ↑ ⇝ zero to low credence
b. ↓↑ ⇝ moderate to high credence
c. ↓↓ ⇝ high credence (Farkas and Roelofsen, 2017: 272)

At least in English utterances, the speaker marks high or low credence in the truth of the highlighted alternative by a falling and a rising sentence-final tune, respectively. The association of rises with low credence and of falls with high credence proposed by Farkas and Roelofsen (2017) is in alignment with intuitions presented in earlier theoretical work on intonational contours and is also supported by empirical work, according to which sentence-final rising tunes are cross-linguistically associated with uncertainty and questionhood, while falling final tunes are associated with certainty and assertivity (Pierrehumbert and Hirschberg, 1990; Gussenhoven and Chen, 2000; Gussenhoven, 2004).

Pierrehumbert and Hirschberg (1990) claim that rises signal that an utterance is to be interpreted "with respect to subsequent utterances". Questions, among other things, qualify as utterances which depend on subsequent utterances (i.e., on an answer). At the same time, utterance-final falls indicate "completeness", that is, the utterance is ready for interpretation in itself, and it does not rely on subsequent utterances. Reliance on subsequent utterances in interpretation is a property that shows itself most prototypically in questions, and completeness, in assertions (cf. the *Frequency code* of Ohala (1994)).

Thus in Farkas and Roelofsen's system, the informative and inquisitive content of an utterance are derivable from the form of the utterance, that is, from its clause type and any marker of formal complexity. The interpretation of these utterances happens by applying the same basic convention, namely that the semantic content of the utterance is added to the TABLE and the informative content of it is added to COMMITMENTS. If the sentence is marked, some special effects are postulated, which share one characteristic: they all modify to some extent the speaker's confidence in the truth of the highlighted proposition.

3. Information-seeking and rhetorical wh-interrogatives

This section proposes to accommodate wh-interrogatives in Farkas and Roelofsen's (2017) inquisitive semantic framework. First, we show how wh-interrogatives are interpreted within the framework, and how the basic conventional discourse effects apply in the case of a wh-interrogative, after which, we model rhetorical wh-questions.

While rhetorical questions can be conveyed by both polar and wh-interrogatives, the reason why we only look at rhetorical wh-questions is because only wh-interrogatives allow us to elicit and obtain natural utterances with all three readings (ISQ, RQ+ and RQ−). Polar interrogatives can convey ISQs and RQ−s but we found it challenging, if not impossible, to elicit naturally sounding polar RQ+s in a laboratory setting.

3.1. Wh-interrogatives in inquisitive semantics

Wh-interrogatives do not have sentence radicals or highlighted alternatives, but they do have what Krifka (2017) calls a *question radical*. Question radicals denote a property, to which Farkas (2020) refers to as the *highlighted property*. Applying the highlighted property to each

individual in the domain of the wh-word yields a *Hamblin*-set (Hamblin, 1973), which we label A (capital α). Consider the following interrogative.

(20) Who likes salty licorice?

Let the domain of *who* in (20) consist of three individuals: Ann, Ben and Cecil. In this context, if we apply the highlighted property of (20), λx.LIKES-SALTY-LICORICE(x) pointwise to each entity in our domain $D = \{\text{Ann, Ben, Cecil}\}$, the resulting set will consist of three pieces of information: $A = \{$'Ann likes salty licorice', 'Ben likes salty licorice', 'Cecil likes salty licorice'$\}$. These pieces of information represent the three alternatives, which we term as α, β and γ. Each alternative consists of information states which support their maximal element. That is, α will consist not only of the information state in which 'Ann likes salty licorice' is supported, but some substates will support 'Ann and Ben like salty licorice' or 'Ann, Ben and Cecil like salty licorice'.

The basic conventional discourse effects of a wh-interrogative consist of the same two components as in (16): updating the TABLE by the inquisitive content of the utterance, and updating COMMITMENTS$_S$ by its informative content. The inquisitive content of a wh-interrogative is P, an inquisitive proposition, consisting of the alternatives that are elements of $(A \cup \overline{A})$. And the informative content of a wh-question is W, just like in the case of polar interrogatives.

(21) Basic conventional discourse effects of a wh-ISQ (with three individuals in D)
a. $A \cup \overline{A} = \{\alpha, \beta, \gamma, \neg(\alpha \vee \beta \vee \gamma)\}^{\downarrow}$ is added to the TABLE
b. W is added to COMMITMENTS$_S$.

Having established the basic conventional discourse effects of wh-interrogatives, we now turn to wh-questions, that is, to the speech acts that interrogatives can convey. ISQs, being canonical questions, have an unmarked form and hence they do not have any special effects. RQs, on the other hand, are non-canonical questions because they deviate from the canonical use in a certain way (Farkas, 2020). RQs therefore have special discourse effects, and special effects are accompanied by a marked form. We first characterize these special effects, and then relate them to their form in Mandarin.

3.2. An inquisitive semantic account of rhetorical wh-questions

RQs have the same basic conventional discourse effects as interrogatives conveying an ISQ. That is, we agree with the question-like analyses of RQs. The marked meaning of RQs is linked to their marked form. One special discourse effect that applies to all RQs, whether they have the form of a polar or a wh-interrogative, and whether they convey a RQ+ or a RQ−, is that the speaker's commitment set is updated by a restricted set of worlds compared to the set determined by the basic conventions of use. First, instead of W, only its intersection with the common ground will be added to COMMITMENTS$_S$, because the answer to a RQ is already given. The TABLE gets updated in exactly the same way as with ISQs, that is, with all of the alternatives contained by the inquisitive proposition.

(22) *Special discourse effect of a RQ*
W in COMMITMENTS$_S$ gets intersected by the cg, that is,
$W \cap cg$ is added to COMMITMENTS$_S$

Besides (22), both RQ+s and RQ−s have their own, distinct, special discourse effects.[4]

3.2.1. Rhetorical questions with a non-empty answer set

In addition to (22), RQ+s also signal that the answer is to be found in A, since by definition, RQ+s suggest a non-empty set as their answer. This is a further restriction on the set of possible worlds that update COMMITMENTS$_S$.

If we take into consideration the addressee's perspective, the message the addressee receives is that i) the answer to the question is already given, and ii) it is some member(s) from the domain denoted by the wh-phrase. But the addressee still needs to "consult" the common ground and the alternatives in A in order to determine which members are found in the intersection of the two, that is, in order to correctly interpret the utterance. This task is similar to what is done upon encountering a ISQ, for which the addressee has to check the domain and consult their privileged ground in order to find the answer.

RQ+s differ from ISQs in that the addressee goes through the intersection of the common ground and the alternatives present in the domain, which is a necessarily smaller set because the empty set is excluded. Due to these facts, the addressee's task is potentially less demanding compared to ISQs. But the issue raised by the RQ+ gets resolved only if the addressee actually shares the relevant piece of information, and we argue that it is this inherent context-dependence that makes RQ+s less-than-fully informative.

Consider again the example domain consisting of Ann, Ben and Cecil, and assume that 'Ann likes salty licorice' is in the common ground. If the addressee hears the RQ+ *Come on, who likes salty licorice?* as in (1b), they will understand that the answer is already common ground and that it is to be found within A. Whenever there is more than one individual in the domain, knowing that the answer is common ground will not be enough to resolve the issue without relying on contextual information (i.e., on the common ground). The addressee still has to find the answer, because they need to find out which alternative in A is supported by the common ground. Therefore, the special effects consist of a restriction on the informative content of the RQ+: COMMITMENTS$_S$ is updated by only those worlds that are compatible with both A and the cg.

(23) *Special effect of a wh-RQ+*
$W \cap cg = \text{info}(A \cup \overline{A}) \cap cg$ in COMMITMENTS$_S$ gets restricted to $\text{info}(A) \cap cg$, that is, $\text{info}(A) \cap cg$ is added to COMMITMENTS$_S$

The special discourse effects (22) and (23) shrink the set of possible worlds in the speaker's commitment set as shown in (24b) and (24c), respectively. The entire set of alternatives ($A \cup \overline{A}$) is put on the TABLE (24a), just as in the case of an ISQ. But the speaker's commitment set gets updated only by the intersection of A and the common ground (24b). In our example context, the alternative α is already part of the common ground, therefore, the addressee will intersect the possible worlds in the common ground by the possible worlds compatible with only α

[4]Note that in Farkas and Roelofsen's (2017) model, special effects affect the set of evidenced possibilities by assigning a certain interval to the highlighted alternative, which expresses the speakers credence level in that alternative. That is, special effects do not modify the update on COMMITMENTS$_S$. However, we assume that using a "shortcut" of directly restricting the set of worlds that update COMMITMENTS$_S$ yields the same result.

(24c). In a non-defective context (i.e., if α is indeed given), there is no difference between the two states of the common ground, the one preceding the update (cg) and the one following it (cg'), and the update in (24c) remains vacuous.

(24) a. TABLE: $\{\alpha, \beta, \gamma, \neg(\alpha \vee \beta \vee \gamma)\}^{\downarrow}$
b. COMMITMENTS$_S$: $\text{info}(A) \cap cg = (\text{info}(\alpha) \cup \text{info}(\beta) \cup \text{info}(\gamma)) \cap cg$
c. $cg' = cg \cap \text{info}(\alpha)$

A RQ+ is both inquisitive and informative. One source of its inquisitiveness is the update on the TABLE: since there are more than one alternatives, the utterance is inquisitive. Another source of its inquisitiveness comes from COMMITMENTS$_S$, which gets updated with info(A), a set of worlds which do not form a single alternative. At the same time, this set of worlds is smaller than W, which makes the utterance informative.

3.2.2. Rhetorical questions with an empty set answer

RQ−s, being RQs, convey that the answer is in the common ground, just like RQ+s do. But in addition to that, they also convey that the answer is the empty set. The basic discourse effects of wh-RQ−s are the same as the ones of any wh-interrogative: they put the union of A and its complement on the TABLE, and they update COMMITMENTS$_S$ by W. In addition to (22), RQ−s have further special discourse effects, namely, they restrict the set of possible worlds that update COMMITMENTS$_S$ to only those that are members of info($\overline{A}$).

(25) *Special discourse effects of a wh-RQ−*:
$\text{info}(A \cup \overline{A}) = W$ in COMMITMENTS$_S$ gets restricted to info($\overline{A}$), that is,
$\text{info}(\overline{A}) \cap cg = \text{info}(\overline{A})$ is added to COMMITMENTS$_S$

The set of alternatives COMMITMENTS$_S$ shrinks due to the two special effects of (22) and (25). The expression on the TABLE is the same as in the case of ISQs: the set consisting of all members of A and of $\overline{A}$, see (26a). However, COMMITMENTS$_S$ does not get updated with the worlds compatible with all of these alternatives, only by ones compatible with the bottom element, $\overline{A}$, as (26b) shows. $\overline{A}$ gets intersected with the common ground, although this update applies vacuously.

(26) a. TABLE: $\{\alpha, \beta, \gamma, \neg(\alpha \vee \beta \vee \gamma)\}^{\downarrow}$
b. COMMITMENTS$_S$: $(\text{info}(\overline{A}) \cap cg) = \text{info}(\overline{A})$

The only alternative that we find in the intersection of COMMITMENTS$_S$ and the common ground is $\overline{A}$, the suggested answer, and this distinguishes RQ−s from RQ+s in terms of informativity and context-dependence. In any given context, the interpretation of the utterance is the same: the answer is the empty set. To understand that, the addressee does not need to rely on contextually given information; as a consequence, an RQ− can be interpreted correctly (i.e., according to the speaker's intentions) even if the addressee does not share the relevant piece of information that the speaker assumes to be common ground. RQ−s are therefore context-independent, and this property is responsible for their strong assertion-like flavor.

However, contrary to Han's (2002) position, we do not consider RQ−s to be completely equivalent to assertions. The fact that RQ−s, too, can be answered is due to their interrogative form, which guarantees inquisitiveness even in the case of such an assertion-like use. RQ−s are thus

both informative and inquisitive, but they are less inquisitive and more informative than RQ+s, as COMMITMENTS$_S$ is updated with an even smaller set of possible worlds than in RQ+s.

We thus analyze RQs as questions that also have an assertive flavor, to a certain extent. While Biezma and Rawlins (2017) propose that RQs immediately resolve the QUD they raise, we propose that, strictly speaking, this is true only of RQ−s, while RQ+s can be resolved the intended way only if the speaker is correct about the addressee's perceived beliefs about the relevant matter. Second, we have shown that RQ+s update COMMITMENTS$_S$ with more worlds than do RQ−s; they are therefore less informative than RQ−s, and this fact holds even in a non-defective context. Both of these difference can be captured by the informativity and inquisitiveness of these utterances, as has been shown in this section.

Lastly, recall that RQ−s were called "generic rhetorical questions" by Jamieson (2018). This label is given based on the intuition that a RQ−s are interpreted not with respect to a given contextual domain, like ISQs and RQ+s are, but with respect to a maximally widened domain. We share the intuition that this generic interpretation is available, however, we do not see it as the only option to interpret RQ−s.

(27) Context: Ann and her big family of 10 went to vote. It is common ground that they all are voters of the least popular candidate A. Before voting, Ann's brother starts googling facts about candidate B.
Ann to her brother: Don't read those. Who would vote for candidate B?

In the context of (27), the speaker most probably did not mean her utterance to be generic, that is, valid for every individual on earth (or even just the set of all non-minor citizens of her country). Assuming that each candidate must have had supporters in order to become a candidate, Ann's RQ is to be interpreted as a RQ− that applies to a domain consisting of their family, with *Who?* being equivalent to *Which one of us?*

Therefore, we propose that a metavariable ε ensuring genericity, as proposed by Jamieson (2018), is not needed. Instead, the optional (or likely) generic interpretation follows from the mere fact that the empty set answer is a special element: we assume that it is present as an alternative in the semantic content of *any* wh-interrogative. This being the case, domain widening can happen quite flexibly across contexts, because the speaker's commitments will be updated by the same possible worlds regardless of the size of the domain.

3.3. Gradient inquisitiveness

Based on their semantic properties, the three question types, ISQs, RQ+s and RQ−s can be ordered inversely on a scale of inquisitiveness and informativity, as follows:

(28) a. Inquisitiveness: assertion < RQ− < RQ+ < ISQ
b. Informativity: ISQ < RQ+ < RQ− < assertion

The two orderings show that assertions are the least inquisitive and the most informative, and ISQs are the most inquisitive and the least informative utterance types. RQs are between the two extremes, but RQ+s and RQ−s differ from each other in terms of inquisitiveness, too: while both convey that the suggested answer is already in the *cg*, RQ−s further indicate that the answer is the empty set. RQ−s therefore convey a resolved issue, which makes them more

informative than RQ+s. RQ−s are still more inquisitive than assertions: An interrogative, regardless of how informative it is, will always be inquisitive to some extent, because of its clause type. This accounts for the fact that RQs, regardless of the kind of answer they suggest, and regardless of the level of informativity, are still always answerable. RQ+s are higher on the inquisitiveness scale than RQ−s, because the addressee still needs to make an effort to resolve the issue: she needs to do a domain search in order to find the right answer in the common ground.

This gradience is the product of two different sources of inquisitiveness. We posit that updates both on the TABLE and in COMMITMENTS$_S$ together determine the extent of inquisitiveness of a wh-interrogative. The update on the TABLE is determined by the clause type of the utterance, and the update on COMMITMENTS is determined by the non-canonical form that contribute the special discourse effects.

4. The prosody of inquisitiveness

As mentioned in section 2.3, intonation plays a crucial role in Farkas and Roelofsen's system. However, since the authors only considered utterance types that have a sentence radical/highlighted proposition, the question arises of how their predictions are applicable to wh-interrogatives. We propose an answer to this question, which is supported by systematic phonetic measurements.

Mandarin ISQs have been observed to have a rising final tune (Zahner et al., 2020; Lo and Kiss, 2020) while assertions display a falling one. Regarding the intonation for RQs, two competing theories on the table make different predictions. On the one hand, if RQs both raise and resolve a QUD, as Biezma and Rawlins (2017) suggest, then we would expect both types of RQs to have a falling final tune. Similarly, the other question-like analyses, which treat RQs as a homogenous group, would also predict that RQ−s and RQ+s behave the same way in terms of pitch contour. On the other hand, if RQs are not a homogenous group, as Jamieson (2018) and ourselves have suggested, then we expect that, not only would RQs be distinguished from ISQs prosodically, but RQ−s and RQ+s would also have distinct prosody.

To address the different predictions put forth by these two competing views on RQs, we conducted a production experiment on Mandarin to compare the prosodic correlates of the three question types. The elicitation material contains a set of wh-interrogatives that follow the same syntactic structure and are compatible with an ISQ, RQ+, or RQ− reading. To elicit these question types, the target sentences were each embedded in three different contexts. Participants read and listened to the context at the same time, and then were shown a two-sentence utterance which they said out loud in a way that matches the given context. The second sentence of this utterance was the target sentence.

The prosodic correlates we considered include total utterance duration, the duration of the wh-word, the duration of the sentence-final particle (SFP), the F0 of the wh-word, and the F0 of the SFP. The mean pitch curves of the three utterance types are shown in Figure 1, and Table 1 shows the main findings of the experiment. The reader interested in further details regarding the design of the stimuli and the measurement and analyses of the recordings is referred to Lo and Kiss (2020).

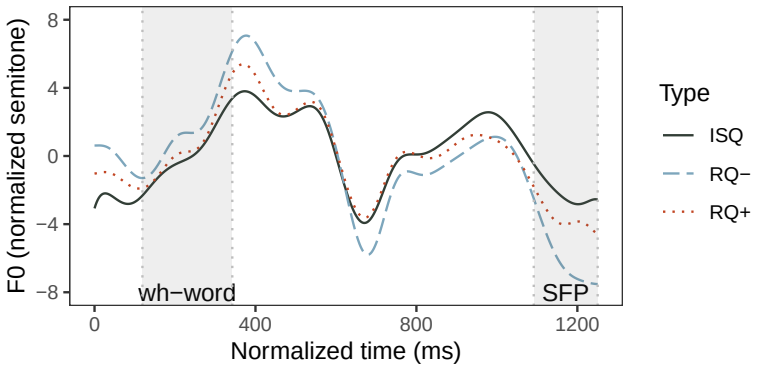

Figure 1: Mean pitch curves of the three question types

Table 1: Summary of the experiment results of Lo and Kiss (2020)

Question type	**Utterance duration**	**SFP duration**	**F0 on *wh*-word**	**F0 on SFP**
ISQ	shorter	longest	lowest	highest
RQ+	longer	In between ISQ and RQ−		
RQ−	longer	shortest	highest	lowest

These results show that while RQ+s and RQ−s do have common prosodic properties, they clearly differ from each other prosodically. Utterance duration distinguishes RQs from ISQs, but not the two types of RQs. The two RQ types differ in terms of the duration of their sentence-final particles, as well as the F0 values on the wh-word and on the sentence-final particle.

These results support the predictions of the framework that treats RQ−s and RQ+s as having different meanings; at the same time, they are consistent with earlier works on the production of ISQs and RQ−s (Dehé and Braun, 2019; Dehé and Braun, 2020) according to which prosodic cues, such as duration and voice quality also contribute significantly to prosodic marking, in addition to sentence-final tunes. Considering the pitch contours on Mandarin sentence-final particles, we see that they are also consistent with Farkas and Roelofsen's (2017) associations in (19), which is based on the idea that utterance-final rises are associated with non-finality or uncertainty, and utterance-final falls, with finality or certainty (Gunlogson, 2003; Gussenhoven, 2004).

The three question types show a three-way prosodic distinction, and we hypothesize that this gradience could be a reflection of the gradience of the inquisitiveness of these questions. Such a conclusion is consistent with recent findings about biased questions in other languages where gradience of speaker certainty has been shown to give rise to gradience in prosody (Prieto et al., 2015; Prieto and Borràs-Comes, 2018; Orrico and D'Imperio, 2020). However, given the exploratory nature of Lo and Kiss (2020), this potential tie between the subtle semantic characteristics of questions and duration/F0 must be examined further (i.e., by perception experiments) before such a relation can be posited conclusively.

5. Open questions

Our proposal for the treatment of wh-interrogatives and rhetorical questions in inquisitive se-

mantics leaves a number of questions open. One such issue is the distribution of minimizers such as *lift a finger* or *budge an inch* across RQs. Most previous accounts examined minimizers in RQ−s only, accounting for how minimizers are licensed (Han, 2002) or why minimizers turn an interrogative obligatorily into a RQ− (Abels, 2003). Given our account, we could speculate that the licensing of minimizers is related to the set of worlds that update COMMITMENTS_S. An update by a RQ− consists of adding a set of worlds that together form an anti-veridical context (Giannakidou, 2013), since all worlds are such that the highlighted property does not hold of anyone in the domain. The fact that RQ+s do not create such a context in COMMITMENTS_S could explain why minimizers only occur in RQ−s. This is an empirical question that, to our knowledge, has not yet been addressed.

But even at a theoretical level, we find examples that are problematic. Example (29), said by someone whose car breaks down in an unfamiliar town, or the utterance of Leader_2 in (30).

(29) Where on earth do I find a mechanic in this town? (Biezma and Rawlins, 2017: 313)

(30) Context: Climate activists demonstrating:
Leader_1: Does the government give a damn about the environment?
Crowd_1: No!
Leader_2: Who gives a damn about the environment?
Crowd_2: We do!

Examples like (29) and Leader_2's utterance in (30) should not be acceptable on Han's (2002) or on Abels' (2003) account on minimizers in RQs, nor according to our speculation about the veridicality of the set of worlds updating the speaker's commitments. We therefore leave this intriguing question for future research.

Another issue concerns the fact that the meaning of a wh-interrogative may vary with the kind of wh-phrase. It has been proposed that wh-phrases introduce an existential presupposition (Karttunen and Peters, 1976; Dayal, 1996), or a defeasible existential presupposition, also called a 'soft' presupposition (Abusch, 2010), or no presuppositions, with the exception of *how come* (Fitzpatrick, 2005). We considered questions with subject-'who' only, and assumed that it introduced no presupposition of existence. This question may have implications to our analysis and to the interpretation of our results, but we do not address it here.

Finally, we remain agnostic about polar RQ+s. While eliciting polar RQ−s went smoothly even in a lab setting, polar RQ+s proved to be problematic, if not impossible. We therefore excluded polar interrogatives altogether from this study. It is not straightforward whether polar RQ+s really exist. The examples cited in the literature are mostly idiomatic, such as *Is the Pope Catholic?* (Schaffer, 2005). Rohde (2006) has found some in the SWITCHBOARD corpus, thus it is reasonable to assume they exist, even if they are less frequent than their empty set denoting counterparts. However, the fact that polar RQ+s exist in English does not mean they also are available in Mandarin.

Be as it may, our analysis applies to polar interrogatives, and could also include polar RQ+s. The suggested answer to a polar RQ− is the complement of the highlighted alternative, $\overline{\alpha}$, and a polar RQ+ would convey that the answer is the highlighted alternative itself. Zahner et al. (2020) showed that Mandarin polar RQ−s indeed differ prosodically from polar ISQs. But the empirical question of whether polar RQ+s and polar RQ−s are prosodically distinguished from

each other remains open.

6. Conclusion

Rhetorical questions are question-like and assertion-like at the same time. We proposed an account based on Farkas and Roelofsen's (2017) inquisitive semantic model that explains both of these properties. We reconcile assertion-like and question-like accounts of RQs by analyzing them as essentially questions that have different degrees of inquisitiveness/informativity, to which we found support from Mandarin production data.

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