Acceptability of interrogatives under be certain

Inquisitive Semantics Seminar

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Verbs can be classified by their ability to take declarative and/or interrogative complements:

<table>
<thead>
<tr>
<th>Rogative</th>
<th>Take only interrogative complements:</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><em>John wonders whether Mary smokes; John asks whether Mary smokes</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Anti-rogative</th>
<th>Take only declarative complements:</th>
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<tbody>
<tr>
<td></td>
<td><em>John thinks that Mary smokes; John believes that Mary smokes</em></td>
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<table>
<thead>
<tr>
<th>Responsive</th>
<th>Take both:</th>
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<tbody>
<tr>
<td></td>
<td><em>John finds out whether/that Mary smokes; John knows whether/that Mary smokes</em></td>
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</tbody>
</table>
How about the verb *be certain*? 

(1) John is certain that Mary smokes ✓

(2) John is certain whether Mary smokes ?

(3) John is not certain whether Mary smokes ✓
It seems that *be certain* is responsive, but only takes interrogative complements under certain circumstances (Egré, 2008; Hölker, 2014; Mayr, 2017).
1. Mayr’s theory

2. Experiments

3. Summary
Mayr's theory
Mayr's theory

Observation: *be certain*+int is licensed in the same environments as negative polarity items (NPI’s) like *any*:

(4) a. #John saw any girl.
   b. John did not see any girl.
Mayr’s analysis is inspired by theories of NPI licensing:

- The literal meaning of a sentence $\varphi$ is strengthened by means of an exhaustivity operator.
- This operator negates all formal alternatives of $\varphi$ which are not entailed by $\varphi$.
- If this strengthening procedure leads to a trivial meaning, $\varphi$ is perceived as ungrammatical.
Example 1

(5) John saw any girl

Literal meaning: $\lambda w.\text{John saw a girl in } w$

Formal alternatives: $\lambda w.\text{John saw Mary in } w$, $\lambda w.\text{John saw Sally in } w$, ...

None of these alternatives are entailed by (5).

$\text{EXH}(5) = \lambda w.\text{John saw a girl in } w \land \text{John did not see Mary in } w \land$

John did not see Sally in $w$, ...
Example 2

(6) John did not see any girl

Literal meaning: $\lambda w. \text{It is not the case that John saw a girl in } w$

Formal alternatives: $\lambda w. \text{John did not see Mary in } w$, $\lambda w. \text{John did not see Sally in } w$, ...

All of these alternatives are entailed by (6).

EXH(6) = (6)
Example 3

(7) John is certain whether Mary smokes

Let $Q = \{[[\text{Mary smokes}]], [[\text{Mary doesn’t smoke}]]\}$

Literal meaning of (7): $\lambda w. \exists p (p \in Q \land \text{Dox}_j(w) \subseteq p)$

Formal alternatives: $\lambda w. \text{Dox}_j(w) \subseteq [[\text{Mary smokes}]]$, $\lambda w. \text{Dox}_j(w) \subseteq [[\text{Mary doesn’t smoke}]]$

None of these alternatives are entailed by (7).

$\text{EXH}(7) = \lambda w. \exists p (p \in Q \land \text{Dox}_j(w) \subseteq p) \land \neg(\text{Dox}_j(w) \subseteq [[\text{Mary smokes}]]) \land \neg(\text{Dox}_j(w) \subseteq [[\text{Mary doesn’t smoke}]])$
Example 4

(8) John is not certain whether Mary smokes

Let $Q = \{[[\text{Mary smokes}]], [[\text{Mary doesn’t smoke}]]\}$

Literal meaning of (8): $\lambda w. \neg \exists p (p \in Q \land \text{Dox}_j(w) \subseteq p)$

Formal alternatives: $\lambda w. \text{Dox}_j(w) \not\subseteq [[\text{Mary smokes}]],$ 
$\lambda w. \text{Dox}_j(w) \not\subseteq [[\text{Mary doesn’t smoke}]]$

Both of these alternatives are entailed by (8).

$\text{EXH}(8) = (8)$
Mayr's theory

**Prediction 1**

(9) and (10) are wrong in a similar manner:

<table>
<thead>
<tr>
<th>(9)</th>
<th>John is certain whether Mary smokes</th>
</tr>
</thead>
<tbody>
<tr>
<td>(10)</td>
<td>John saw any girl</td>
</tr>
</tbody>
</table>

Mayr explains the degradedness of (9) by deriving that it is systematically contradictory. However, it is usually assumed that such systematic contradictoriness gives rise to judgments of *ungrammaticality* (Gajewski, 2002). Although this seems fitting for (10), it may be too strong for (9).
Prediction 2

Although (11) is bad, there is nothing wrong with (12):

(11) John is certain whether Mary smokes

(12) Both John and Bill are certain whether Mary smokes.

Since John and Bill can both be certain whether Mary smokes, but still disagree with each other (e.g. John is certain that she smokes, Bill is certain that she doesn’t), the negations of the alternatives are not incompatible with the literal meaning. Thus, since no contradiction arises, (12) is predicted to be grammatical.
Experiments
Participants were asked to judge the acceptability of sentences like the following:

(13)  

a. Ava is certain which movie William watched  
    (unembedded)  

b. William is not certain which movie Olivia watched  
    (negation)  

c. Both Olivia and Emily are certain which movie Grace watched  
    (‘both’)  

Other variants:

• With believe, think, know  

• Declarative complement (that Ann watched a movie)  

Judgments on a five point scale between odd (1) and natural (5).
Experiment 1

![Graph showing mean acceptability of expressions with different embeddings and negations in Declarative and Interrogative forms for 'know', 'be certain', and 'believe/think'.]
Under *think* and *believe*, questions were clearly degraded under any embedding.
Under *know*, questions were as good as declaratives in plain contexts, although they were slightly degraded under negation and *both*. 
For **be certain**, we observed the opposite: questions were degraded in unembedded contexts, but this effect disappeared under negation and **both**.
Conclusions from this experiment:

• We find that *be certain-wh* in positive episodic sentences is indeed degraded.

• This effect disappears when *be certain-wh* appears under negation or *both*.

• It seems that the degradedness of *be certain-wh* and the ungrammaticality of unlicensed NPI’s do not have exactly the same status.
But...

- We performed the experiment with *wh*-questions rather than polar questions.
- We did not collect any data to compare judgements of sentences with unlicensed NPI’s.
- We did not test whether judgements are different with a preposition like *about* or *as to*.
- We wanted to test two of Mayr’s other predictions about *be certain* with interrogatives.
Prediction 3

Like NPI’s, *be certain* can appear in the antecedent of a conditional, but not in the consequent.

(14)  

a. If John is certain whether Mary smokes, he knows her well.  
b. #If John knows Mary well, he is certain whether she smokes.
**Prediction 4**

Like NPI’s, *be certain*+int can appear in the restrictor of a universal quantifier, but not in its scope.

(15)  

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Every student who is certain whether Mary smokes knows her well.</td>
</tr>
<tr>
<td>b.</td>
<td>?Every student who knows Mary well is certain whether she smokes.</td>
</tr>
</tbody>
</table>

Note: Mayr’s formalization does not predict (b) to be contradictory.
We added the following conditions:

• Sentences with NPI *any*
• NPI/verb in antecedent/consequent of conditional
• NPI/verb in restrictor/scope of universal quantifier
• Polar questions
• *be certain*+int with preposition *as to*
Experiment 2

<table>
<thead>
<tr>
<th>know</th>
<th>be certain</th>
<th>NPI</th>
<th>believe</th>
<th>think</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unembedded</td>
<td>Both</td>
<td>Negation</td>
<td>Unembedded</td>
<td>Both</td>
</tr>
<tr>
<td>Restrictor</td>
<td>Scope</td>
<td>Antecedent</td>
<td>Consequent</td>
<td>Restrictor</td>
</tr>
</tbody>
</table>

Acceptability:
- Predicted
- Degraded
- Good

20/29
No significant difference between questions with/without preposition
NPI’s are judged as expected
Restrictor and scope variant of \textit{be certain+int} behave in the opposite direction of Mayr’s predictions.
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>know</td>
<td>be certain</td>
<td>NPI</td>
<td>believe</td>
<td>think</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

Same for antecedent/consequent, but to a lesser extent
We did not measure the positive effect of *both* over the unembedded variant that we measured in experiment 1.
Variants with *be certain* + *wh*-question:

(16)  
\(a\). Both Ethan and Emma are certain which movies Madison watched  
\(b\). Everyone who is certain which books Elizabeth likes knows her well  
\(c\). If Ethan is certain which movies Ava watched, then he knows her well  

Variants with *be certain* + polar question:

(17)  
\(a\). Both Ethan and Madison are certain whether Ava likes watching movies or not  
\(b\). Everyone who is certain whether Anthony likes watching movies or not knows him well  
\(c\). If John is certain whether Elizabeth likes watching movies or not, then he knows her well  

The degradedness of \((b)\) and \((c)\) may be caused by their obvious falsehood or length.
Goals:

• Make the design more consistent
• Add a context in which all sentences should be natural (and at least not obviously false)
<table>
<thead>
<tr>
<th>Verb/particle:</th>
<th>Construction:</th>
<th>Complement:</th>
</tr>
</thead>
<tbody>
<tr>
<td>know</td>
<td>unembedded</td>
<td>interrogative</td>
</tr>
<tr>
<td>be certain</td>
<td>negation</td>
<td>declarative</td>
</tr>
<tr>
<td>think</td>
<td>antecedent</td>
<td></td>
</tr>
<tr>
<td>any</td>
<td>consequent</td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>restrictor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>scope</td>
<td></td>
</tr>
</tbody>
</table>
A school class is having a geography quiz. The teacher asks questions like “Is Paris the capital of France?”. When the children want to answer, they have to raise their hand.

Such a context should make the restrictor/scope sentences more natural:

(18)  a. Everyone who knows/is certain whether A is the capital of B or not raised their hand.
      b. Everyone who raised their hand knows/is certain whether A is the capital of B or not.
NPI’s are as expected, although *scope* and *consequent* less degraded than before
**Experiment 3**

<table>
<thead>
<tr>
<th>Know</th>
<th>Be Certain</th>
<th>Think</th>
<th>NPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unembedded Negation Restrictor Scope Antecedent Consequent</td>
<td>Unembedded Negation Restrictor Scope Antecedent Consequent</td>
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**Acceptability**

- **Predicted**
  - Degraded
  - Good

**be certain+int**: clear difference between unembedded and negated variant
be certain+int: similar to experiment 2 for restrictor/scope
**be certain**\textsuperscript{+int}: difference between antecedent/consequent is small
**Experiment 3**

Know: all question complements except negation are suddenly degraded
Variants with *know* + interrogative:

(19)  

a. Jacob knows whether A is the capital of B or not.  
b. Benjamin does not know whether A is the capital of B or not.  
c. Everyone who knows whether A is the capital of B or not raised their hand.  
d. Everyone who raised their hand knows whether A is the capital of B or not.  
e. If Chris knows whether A is the capital of B or not, then he will raise his hand.  
f. If Madison raised her hand, then she knows whether A is the capital of B or not.
• Capital-country pairs were randomly correct or incorrect.
• We measured a small effect of correctness with *scope* and *restrictor*, but not enough to account for the weird results of *know*
• No effect of participant state
Summary
Summary

- Mayr’s prediction that *be certain+int* is degraded in positive episodic sentences is correct.
- The effect is not always as strong as with NPI’s or as *think-wh*, but with polar questions it can be quite strong (especially in experiment 3)
- The effect disappears under negation
- We only found that the effect disappeared with plural subjects in the first experiment
- Restrictor/scope and antecedent/consequent do not follow the pattern of NPI’s

