Highlighting in discourse and grammar

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XPrag workshop on
Questions, Answers, and Negation

January 26, 2016

1 Introduction

Background: nominal discourse referents

- Consider the following famous examples that Heim (1982) attributes to Barbara Partee:

  (1)   a.   I dropped ten marbles and found all of them except for one.
            It is probably under the sofa.

        b.   I dropped ten marbles and found only nine of them.
            # It is probably under the sofa.

- These examples have been used to argue that the meaning of a declarative sentence, or at least its role in discourse, is not fully determined by its truth-conditions.

- After all, the first sentence in (1a) is truth-conditionally equivalent with the first sentence in (1b).

- This has led to **dynamic** theories of meaning (Kamp, 1981; Heim, 1982; Groenendijk and Stokhof, 1991, and many others).

- In these dynamic theories, the meaning of a sentence does not just comprise the information that it provides, i.e., its truth-conditions, but also the **discourse referents** that it makes available for subsequent anaphoric reference.

- The first sentence in (1a) introduces a discourse referent that serves as antecedent for the anaphoric pronoun in the second sentence.

- The first sentence in (1b) does not introduce such a discourse referent; as a consequence, the anaphoric pronoun in the second sentence is difficult to interpret, which leads to incoherence.

More background: propositional discourse referents

- Discourse referents can be entity-level but also **propositional**.

  (see, e.g., Asher, 1986; Cornish, 1992; Geurts, 1998).

- Consider the following examples (from Roelofsen and Farkas, 2015):

  (2)   Is the number of planets even↑?
  - a.   Yes.   ⤳ it's **even**
  - b.   No.   ⤳ it's **odd**

  (3)   Is the number of planets odd↑?
  - a.   Yes.   ⤳ it's **odd**
  - b.   No.   ⤳ it's **even**

  (4)   Is the number of planets even↑ or odd↓?
  - a. #Yes.
  - b. #No.

- These examples can be used to make a similar point as the marble examples, but now concerning **questions**.

- The point is that the meaning of a question, or at least its role in discourse, is not fully determined by its **resolution-conditions**.

- After all, the questions in (2)-(4) all have the same resolution conditions: any piece of information that resolves one of them resolves the others as well.

- And yet, answer particles like *yes* and *no* receive different interpretations in response to (2) and (3), while in response to (4) they are not interpretable at all.

  (Similar observations apply to expressions like *otherwise* and *if so*)

- To account for these contrasts, it may be assumed that even though the questions in (2)-(4) have the same resolution-conditions, they introduce different **discourse referents**, just like the declaratives in (1); and that answer particles like *yes* and *no* are anaphoric expressions, just like the pronoun *it* in (1).

- This is indeed the gist of a number of accounts of answer particles.

  (Ginzburg and Sag, 2000; Roelofsen and van Gool, 2010; Farkas, 2011; Krifka, 2013; Roelofsen and Farkas, 2015).[1]

- The difference between (1) and (2)-(4) is that the relevant discourse referents are of a **different semantic type**:

  - The indefinite in (1a) introduces an **individual** discourse referent;
  - The questions in (2)-(4) introduce **propositional** discourse referents.

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[1]There are also accounts of answer particles that take them to be elliptical rather than anaphoric (e.g., Kramer and Rawlins, 2009). For an overview and comparison, see Roelofsen and Farkas (2015).

Our aim today

The main question that I want to address today is the following:

> Is a semantic/pragmatic theory that captures the propositional discourse referents that sentences introduce only needed to deal with propositional **anaphora**, or also to deal with **other kinds of phenomena**?

From an **empirical perspective**, pursuing this question may lead to:

- New insights concerning phenomena that have been **puzzling** for approaches purely based on truth/resolution-conditions;

- New puzzles that remained **unnoticed** under the purely truth/resolution-conditional perspective;

From a general **theoretical perspective**, it may provide new motivation for a dynamic perspective on meaning.

From introducing discourse referents to highlighting

- A first important step in addressing our main question is... **rephrasing** it.

- In particular, it is important to recognize that the notion of **introducing a discourse referent** is too specific for our purposes.

- Since this notion is **intrinsically connected to anaphora**, chances that it may be relevant for a broader range of phenomena are very slim.

- It is possible, however, to say everything we have said so far in terms of a more basic and more general notion, whose potential relevance for a broader range of phenomena does seem plausible enough to warrant serious consideration.

- This more basic notion is that of **making something salient** (cf., Lewis, 1979).

- For instance:

  - The question in (2) makes the proposition 'that the number of planets is even' particularly salient;

  - The question in (3) makes the proposition 'that the number of planets is odd' particularly salient;

  - The question in (4) makes both of these propositions particularly salient.

- For short, we say that the propositions that are made particularly salient by a sentence are **highlighted** by that sentence.[2]

- As a consequence of being highlighted, a proposition may become available for subsequent anaphoric reference.

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[2]The term 'highlighting' comes from Roelofsen and van Gool (2010). The same notion was proposed independently by Farkas (2011) under the term 'foregrounding'. In both works, the notion was used to account for answer particles and was not yet envisaged to have potential applications beyond anaphora.

- But this is not, or at least not necessarily, the *only* possible consequence.

- For instance, if a speaker utters a sentence that highlights a certain proposition, there may be certain **pragmatic effects**. It may be implied, e.g., that the highlighted proposition is of **particular relevance**.

- There may also be certain **semantic effects**. For instance, some **propositional attitude verbs** may be sensitive to what is highlighted by their complement.

- So the notion of highlighting is **more general** than the notion of introducing a salient discourse referent. The difference is subtle, but crucial for our purposes.

Thus, our main question becomes:

> Is a semantic/pragmatic theory that captures the propositions **highlighted** by a sentence only needed to deal with **anaphora**, or also to deal with **other phenomena**?

What kinds of phenomena should we consider?

- As already anticipated above, there are two broad classes of phenomena to consider:

  1. **Discourse phenomena.**
     - Answer particles and other discourse anaphora fall under this header.
     - But there may be more: relevance implicatures, other pragmatic effects,. . .
  2. **Grammatical phenomena.**
     - Sensitivity of embedding verbs to what is highlighted by their complement.
     - Perhaps also other sentential operators (e.g. conditionals) or particles (e.g. *even*).

- The split into discourse phenomena and grammatical phenomena is important because it may tell us something about how the propositions highlighted by a sentence are to be **computed**.

  - If highlighting is only relevant for **discourse phenomena**:
    * Then the propositions that are highlighted by a sentence can probably just be computed at the **root-level**.
    * In this case, highlighting can be treated as a dimension of meaning that is quite **separate from truth-conditions and resolution-conditions**.
  - If highlighting is also relevant for **grammatical phenomena**:
    * Then the computation of highlighted propositions needs to be incorporated into the **compositional** interpretation procedure, **intertwined** with the computation of truth-conditions and resolution-conditions.

Roadmap

- I will discuss two phenomena today where highlighting seems relevant:

  - **§2**: One discourse phenomenon:
    * **Dependency implicatures** arising from response questions
      (drawing on Groenendijk, 2015)
  - **§3**: One grammatical phenomenon:
    * **Selectional restrictions** of question-embedding verbs like *realize/surprise*
      (drawing on Herbstritt, 2014; Herbstritt, Roelofsen, and Aloni, 2015)

- The **appendix** briefly discusses some further phenomena.

- Disclaimer:

  - The focus today is on providing empirical motivation for a highlighting-sensitive semantics.
  - Not on actually spelling out such a semantics in detail.

2 Highlighting in discourse: response questions

Empirical observations to account for

- Groenendijk (2015) considers the following kinds of dialogues:[3]

  (5)   A: Will Peter go to the party?
         B: Will Quinn go?   ⇐ *response question*
         A: Yes.
         B: Then Peter will go as well.   ⇐ *conclusive final response*

  (6)   A: Will Peter go to the party?
         B: Will Quinn go?   ⇐ *response question*
         A: Yes.
         B: Then I don't know.   ⇐ *inconclusive final response*

- Groenendijk is interested in cases where:

  - the participants are both trying to establish a common ground that **settles the initial question**, and
  - they are both **fully cooperative**.

- Besides the **felicitous** dialogues in (5) and (6), there are also **infelicitous** ones. This happens in particular with **disjunctive** response questions:

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[3]All the empirical observations in this section come from Groenendijk (2015). The account that I will suggest, however, is a bit different from the one originally proposed by Groenendijk.

(7)   A: Will Peter go to the party?
        B: Is the party on Saturday↑, or on Sunday↑?
        A: It's on Saturday.
        B: #Then I don't know.

- Interestingly, it is crucial that we have an **open disjunctive question** here, with rising intonation on both disjuncts.

- An **alternative question**, with falling intonation on the final disjunct, does not give rise to infelicity:

(8)   A: Will Peter go to the party?
        B: Is the party on Saturday↑, or on Sunday↓?
        A: It's on Saturday.
        B: ✓Then I don't know.

- A **polar disjunctive question** does not give rise to infelicity either (this case is structurally the same as (6) above, with a plain polar question):

(9)   A: Will Peter go to the party?
        B: Is the party on Saturday-or-Sunday↑?
        A: Yes.
        B: ✓Then I don't know.

- A **wh-question** does not give rise to infelicity either:

(10)   A: Will Peter go to the party?
        B: When is the party?
        A: It's on Saturday.
        B: ✓Then I don't know.

- Finally, note that in the case of an **open disjunctive question** infelicity only arises if A **confirms** one of the explicitly specified alternatives:

(11)   A: Will Peter go to the party?
        B: Is the party on Saturday↑, or on Sunday↑?
        A: No, it's on a weekday.
        B: ✓Then I don't know.

How to account for these observations?

- Groenendijk's basic idea:

  - It is only cooperative for B to ask a certain response question Q_B if there is **at least one possible answer** to Q_B that **would help** B **in answering** Q_A.

  - I am going to simplify a bit here and equate "would help B in answering Q_A" with "would allow B to answer Q_A".

– In general this is not correct because Q_B might be part of a larger strategy, consisting of multiple response questions, which together may in the end allow B to answer Q_A. But this is not so important for our current purposes.

- More formally:

    – I will assume an inquisitive semantics treatment of questions, but this is not crucial at this point; the same idea can easily be formulated in a Hamblin semantics or other frameworks.

    – In inquisitive semantics, the meaning of a question is the set of all **information states** that **resolve** the question.

    – For instance:[4]

    $[\![\text{Did Peter leave?}]\!] = \{\{w \mid \text{Peter left in } w\}, \{w \mid \text{Peter did not leave in } w\}\}^{\downarrow}$

    – The maximal elements in this set:

    $$\{w \mid \text{Peter left in } w\} \quad \text{and} \quad \{w \mid \text{Peter did not leave in } w\}$$

    are called the **alternatives** in the question meaning.

    – The **cooperativity requirement** for B then formally amounts to:

    (12)   There is at least one alternative $\alpha \in [\![Q_B]\!]$ such that:
        a. $\alpha \cap \mathsf{info}(B) \neq \emptyset$
        b. $\alpha \cap \mathsf{info}(B) \in [\![Q_A]\!]$

    – In words:

    (13)   There is at least one alternative α in Q_B, which is such that:
        a. α is consistent with $\mathsf{info}(B)$
        b.   the information in α and in $\mathsf{info}(B)$ together resolve Q_A

    – If this requirement is fulfilled we say that Q_A **partially depends on** Q_B relative to $\mathsf{info}(B)$.

- How does this basic idea fare?

    – It allows us to **derive basic dependency implicatures**.

    – For instance, from B's response question in (8) we can infer that B's information state is such that either (i) learning that the party is on Saturday will help her to answer Q_A, or (ii) learning that the party is on Sunday will help her to answer Q_A.

    – Similarly, from B's response question in (9) we can infer that B's information state is such that either (i) learning that the party is during the weekend will help her to answer Q_A, or (ii) learning that the party is during the week will help her to answer Q_A.

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[4]For any set of information states S, $S^{\downarrow}$ denotes the set $\{s \mid s \subseteq s' \text{ for some } s' \in S\}$.

– But we **cannot explain the infelicity** of (7) yet.

– After all, according to the given requirement, B can cooperatively ask the given response question if (i) upon learning that the party is on **Sunday**, she would know whether Peter will go, but (ii) upon learning that the party is on **Saturday**, she would still not know whether Peter will go.

– So, after learning that the party is on **Saturday**, it should be felicitous for her to say *Then I don't know.*

Then what goes wrong in (7)?

- Intuitively, I think what goes wrong is the following:[5]

  – Consider B's response question:

  (14)   Is the party on Saturday↑, or on Sunday↑?

  – B **lists two alternatives**, but by means of the final rise she indicates that **there are other alternatives** as well, i.e., other ways of resolving the issue.

  – B does not presuppose that one of the explicitly listed alternatives is true.

  – We can think of open disjunctive questions as **open lists**: they specify two or more alternatives, but indicate that there are other alternatives as well.[6]

  – This is different in the case of **alternative questions**.

  – In that case, **all relevant alternatives** are explicitly listed, and it is presupposed that one of the listed alternatives holds.

  – So alternative questions can be thought of as **closed lists**.

  – The case of **polar questions** is also different.

  – Polar questions just specify one alternative and elicit confirmation or denial of that alternative.

  – Technically, polar questions can be seen as a limit case of open lists, with just one specified list item.

  – But there is a conceptual difference between this case and the case in which multiple list items are specified.

  – We only speak of a **'proper list'** if **two or more alternatives** are explicitly listed.

  – Now, if a speaker explicitly lists **two or more** alternatives, **but not all** of them, then she should have some **reason** for listing exactly the ones she does, and not others.

  – One good reason for this could be that confirmation of one of the explicitly listed alternatives would be particularly **useful** for her (cf., van Rooij and Šafářová, 2003).

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[5]The diagnosis I give here is different from the one suggested by Groenendijk (2015). I should note that the analysis given here is in a very preliminary stage; many issues still need to be considered in further detail.

[6]See Zimmermann (2000); Roelofsen (2013); Roelofsen and Farkas (2015) for elaborate discussion of this conception of disjunctive sentences as 'lists'.

– It is plausible to assume that this is an important consideration for B in formulating a response question: which alternatives would, if confirmed, help to answer Q_A?

– I suggest that this is why, if one of the alternatives listed in an open disjunctive question is indeed confirmed, it is infelicitous for B to conclude *Then I don't know*.

– If confirmation of one of the listed alternatives does not help her, then she should have made a different choice in formulating her response question.

- More formally:

  – <u>Basic cooperativity requirement for response questions</u>

  Q_A must **partially depend on** Q_B relative to $\mathsf{info}(B)$. That is:

  (15)   There is at least one alternative $\alpha \in [\![Q_B]\!]$ such that:
        a. $\alpha \cap \mathsf{info}(B) \neq \emptyset$
        b. $\alpha \cap \mathsf{info}(B) \in [\![Q_A]\!]$

  – <u>Additional requirement, sensitive to highlighting</u>

  If two or more but not all alternatives in Q_B are **highlighted**, i.e., if Q_B is a proper open list, then every highlighted alternative α must partake in the partial dependency between Q_A and Q_B relative to $\mathsf{info}(B)$. That is:

  (16)   For every **highlighted** alternative $\alpha \in [\![Q_B]\!]$:
        a. $\alpha \cap \mathsf{info}(B) \neq \emptyset$
        b. $\alpha \cap \mathsf{info}(B) \in [\![Q_A]\!]$

- Back to example (7):

  – $[\![Q_B]\!]$ contains **three alternatives**: 'Saturday', 'Sunday', 'during the week'.

  – Only **two highlighted**: 'Saturday' and 'Sunday'.

  – **Prediction**: if B learns that the party is on Saturday, or if she learns that it is on Sunday, she should be able to resolve Q_A.

  – So it is infelicitous for her to conclude with *Then I don't know*.

What is predicted for alternative questions?

- Recall the relevant example:

  (17)   A: Will Peter go to the party?
        B: Is the party on Saturday↑, or on Sunday↓?
        A: It's on Saturday.
        B: ✓Then I don't know.

- Now $[\![Q_B]\!]$ contains **two alternatives, both highlighted**.

- This means that Q_B is only subject to the basic cooperativity requirement.

- Q_A just has to partially depend on Q_B relative to $\mathsf{info}(B)$.

- So B's inconclusive final response is predicted to be fine.

What about polar questions?

- Recall the relevant example:

  (18) A: Will Peter go to the party?
        B: Is the party on Saturday? / Is the party on Saturday-or-Sunday?
        A: Yes.
        B: ✓Then I don't know.

- Now $[\![Q_B]\!]$ contains **two alternatives, one of them highlighted**.

- Again, Q_B is only subject to the basic cooperativity requirement.

- Q_A just has to partially depend on Q_B relative to $\mathsf{info}(B)$.

- So B's inconclusive final response is predicted to be fine.

What about wh-questions?

- Recall the relevant example:

  (19) A: Will Peter go to the party?
        B: When is the party?
        A: It's on Saturday.
        B: ✓Then I don't know.

- Now $[\![Q_B]\!]$ contains **many alternatives, none of them highlighted**.[7]

- Again, Q_B is only subject to the basic cooperativity requirement.

- Q_A just has to partially depend on Q_B relative to $\mathsf{info}(B)$.

- So B's inconclusive final response is again predicted to be fine.

One more prediction about open disjunctive questions

- Recall that infelicity only arises if A confirms one of the explicitly specified alternatives:

  (20) A: Will Peter go to the party?
        B: Is the party on Saturday↑, or on Sunday↑?
        A: No, it's on a weekday.
        B: ✓Then I don't know.

- $[\![Q_B]\!]$ contains **three alternatives, two of them highlighted**.

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[7]We will return to the issue of what exactly is highlighted by a wh-question.

- So Q_B is subject to the additional cooperativity requirement.

- But this additional requirement only pertains to the highlighted alternatives.

- So B's inconclusive final response is again predicted to be fine.

Summing up and looking ahead

- The observed pattern follows from seemingly reasonable considerations about the **pragmatics of response questions**, in particular when such questions list several alternatives.

- In order to make these considerations precise, it is crucial to take into account which alternatives are **highlighted** by the sentences in question.

- Thus, the relevance of highlighting indeed seems to reach beyond anaphora.

- So far, however, we have remained in the realm of discourse phenomena.

- We have made a case that highlighting is relevant for pragmatics.

- What if we look at grammatical phenomena? Does highlighting leave its marks there as well?

- If so, we could make a case that highlighting is not only relevant for pragmatics but also for compositional semantics.

3 Highlighting in grammar: embedded questions

This section is based on Herbstritt, Roelofsen, and Aloni (2015).[8]

Empirical observations to account for

- The first issue that Karttunen (1977) raises is:

  - Do all embedded questions belong to the **same syntactic category**?

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[8]Several explanations of the puzzle considered here have been suggested in the literature (d'Avis, 2002; Abels, 2004; Guerzoni, 2007; Sæbø, 2007; Romero, 2015). See Herbstritt *et al.* (2015) for a comparison of most of these accounts with the one presented here. A detailed comparison with Romero (2015), which appeared after we completed the paper, is left for another occasion. For now, we note that Romero's account only addresses part of the puzzle: (i) she considers alternative questions but not polar questions, and (ii) she considers emotive factive verbs like *surprise* but not epistemic verbs like *realize*. Moreover, the account that Romero gives of **surprise whether* is difficult if not impossible to separate from the prediction that verbs like *surprise* only license weakly exhaustive readings when taking *wh*-complements, something that has indeed been claimed by Berman (1991), Heim (1994) and Guerzoni and Sharvit (2007), among others, but has been contradicted by Klinedinst and Rothschild (2011) and Theiler (2014) (see also Uegaki, 2015, p.84-85 for an overview and discussion of this debate). Recent experimental results of Cremers and Chemla (2016) show that *surprise* indeed admits strongly exhaustive readings, a fact that is problematic for Romero (2015) as well as Guerzoni (2007), who also ties the unacceptability of *whether*-complements to the presumed unavailability of strongly exhaustive readings.

- In particular, should **wh-questions** be treated as belonging to the same syntactic category as **whether-questions**?

- To answer this question, Karttunen compares the **distribution** of these two types of questions.

- By and large, they have the same distribution. For instance:

  (21)   a.   John knows what they serve for breakfast.
             b.   John knows whether they serve breakfast.

  (22)   a. *John assumes what they serve for breakfast.
             b. *John assumes whether they serve breakfast.

- But there are exceptions!

- Karttunen notes that **emotive factives** like *amaze*, *surprise*, *bother*, *disappoint*, and *be happy* take *wh*-complements but do not allow *whether*-complements.

  (23)   a.   It is amazing what they serve for breakfast.
             b. *It is amazing whether they serve breakfast.

- Karttunen concludes:

  > The ungrammaticality of (23b) [...] poses problems for me and requires some special treatment. Nevertheless, it seems correct to assume, in the light of the great majority of cases of overlapping distribution, that *wh*-questions and *whether*-questions should be assigned to the same syntactic category.

- In much subsequent work, Karttunen's conclusion has been taken to heart.

- But if *wh*-questions and *whether*-questions are indeed of the same syntactic category, a semantic or pragmatic explanation is needed for the contrast in (23).

- After Karttunen's initial observations, it has been noted in the literature that the *wh/*whether* contrast is not only exhibited by emotive factives but also by certain **epistemic factives** like *realize* and *anticipate* (see, e.g., Guerzoni, 2007).

  (24)   a.   Amy realized what Bill was telling her to do.
             b. *Amy realized whether Bill was telling her to leave the room.

- Moreover, these verbs are incompatible with *whether*-questions in general: not just with **polar questions** but also with **alternative questions**.

  (25)   *It is amazing whether they serve breakfast in the lounge or in the boardroom.

  (26)   *Amy realized whether Bill was telling her to leave or to stay.

- We will refer to this as the ***whether*-puzzle** and to the relevant class of verbs as ***whether*-verbs**.

What is needed to account for the puzzle?

- We need to understand two things:

    1. **Verbs**: What is special about **whether*-verbs? What is the relevant property that they share, and that distinguishes them from other verbs?

    2. **Questions**: What is the crucial difference between *wh*-questions and *whether*-questions?

- Concerning the second issue, it is important to note that there is **no way** we can account for the contrast between *wh*-questions and *whether*-questions just in terms of their **answerhood/resolution conditions** (see also Romero, 2015).

    (27)   *Context: Ann and Chris have placed an order online. They are kept up to date about the status of the order, which is first 'in progress' and then at some point turns into 'sent'. Ann looks at her email and then tells Chris:*
    a.   It is amazing what the status of the order is.
    b.   *It is amazing whether the order is still in progress.
    c.   *It is amazing whether the order is still in progress or not.
    d.   *It is amazing whether the order is still in progress or already sent.

- All embedded questions in these examples have the **same resolution conditions**.

- And yet, the *wh*-question is licensed while the *whether*-questions are not.

- So to account for the puzzle, we have to look beyond resolution conditions.

- What is it, then, that distinguishes *wh*-questions from *whether*-questions?

Highlighting

- We suggest that the relevant difference concerns what is highlighted by the different types of questions.

- It is plausible to assume that the **polar question** in (28) highlights the proposition 'that they serve breakfast'. Indeed, this proposition can be referred to by anaphoric expressions like *yes* and *no*:

    (28)   Do they serve breakfast?
    a.   Yes.   ⤳ they serve breakfast
    b.   No.   ⤳ they don't serve breakfast

- Similarly, it is plausible to assume that the **alternative question** in (29) highlights **two propositions**: 'that they serve breakfast in the lounge' and 'that they serve breakfast in the boardroom'. These propositions cannot be referred to by anaphoric expressions like *yes* and *no*, because these expressions require a unique most salient antecedent, just like anaphoric pronouns (Krifka, 2013; Roelofsen and Farkas, 2015).

    (29)   Do they serve breakfast in the lounge↑ or in the boardroom↓?
    a. #Yes.

b. #No.

- Finally, it is plausible to assume that the **wh-question** in (30) does not make a proposition available for subsequent anaphoric reference, but rather a *property*, i.e., a function from individuals to propositions (see, e.g., Groenendijk and Stokhof, 1984; Krifka, 2001; Aloni *et al.*, 2007; Roelofsen and Farkas, 2015).

(30)   What do they serve for breakfast?

- The property highlighted by (30) is the function that maps every x to the set of worlds where x is served for breakfast:

(31) $\lambda x.\lambda w.\mathsf{they\text{-}serve\text{-}for\text{-}breakfast}(x)(w)$

- It is often assumed in the literature on *wh*-questions that this property is anaphorically accessed in the interpretation of **short answers** to the given question, as in (32a), and even in the interpretation of **full sentential answers**, to compute their **exhaustive** interpretation, illustrated in (32b).[9]

(32)   What do they serve for breakfast?
    a.   Eggs and cereals. $\rightsquigarrow$ they only serve eggs and cereals
    b.   They serve eggs and cereals. $\rightsquigarrow$ they only serve eggs and cereals

- A **proposition** can be viewed as a 0-**place property**.

- So a question always highlights one or more n-place properties, where $n \geq 0$ is the number of *wh*-elements in the question.

    – A **polar question** highlights a single 0-place property, i.e., a proposition;

    – An **alternative question** highlights two or more 0-place properties;

    – A **simple wh-question** highlights a 1-place property;

    – A **multiple wh-question** highlights an n-place property, with $n \geq 2$.

- So now we have an independently motivated way of distinguishing the various question types.

- What about the relevant class of verbs?

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[9] It should be noted that this assumption is not uncontroversial. On the one hand, some authors have argued that short answers actually involve *ellipsis*, and their interpretation involves reconstructing the syntactic structure of the elided material rather than purely anaphoric access to the semantic property made available by the question (see, e.g., Merchant, 2005 for such a proposal, and Jacobson, 2012 for a critique of it). On the other hand, some authors have argued that the *exhaustive* interpretation of answers to questions comes about through pragmatic reasoning, rather than a semantic process that involves anaphoric access to the property made salient by the question (see, e.g., Westera, 2013). Be this as it may, it remains plausible to assume that *wh*-questions bring a certain property into salience which *could* in principle serve as the antecedent for subsequent anaphora, and which could play other roles in the interpretation process as well.

What is special about *whether-verbs?

- We start with an empirical observation from d'Avis (2002):

  – When verbs like *amaze* and *surprise* take a *wh*-question as their complement, they give rise to an **existential presupposition**.

- For instance, (33) implies that something is served for breakfast, and this implication is preserved under negation.

  (33)   It is amazing what they serve for breakfast.
           ⤳ they serve something for breakfast

  (34)   It is not amazing what they serve for breakfast.
           ⤳ they serve something for breakfast

- This presupposition seems to be characteristic for **emotive factives** in general, and also for the relevant **epistemic factives**.

- For instance, (35) implies that Bill has eaten something, and this implication is again preserved under negation.

  (35)   Amy realizes what Bill has eaten.
           ⤳ Bill has eaten something

  (36)   Amy doesn't realize what Bill has eaten.
           ⤳ Bill has eaten something

- Note that it is **odd to cancel** the existential implication with *if anything*.

  (37)   It is amazing what they serve for breakfast, *if anything.

  (38)   Amy realizes what Bill has eaten, *if anything.

- This contrasts with other verbs:

  (39)   Tell me what they serve for breakfast, if anything.

  (40)   Amy knows what Bill has eaten, if anything.

Characterizing the existential presupposition more precisely

- Let us say that an n-place property P is **satisfiable** in a world w just in case there is at least one tuple t of n individuals such that $P(t)$ is true in w.

- Note: if P is a 0-place property, i.e., a **proposition**, then it is satisfiable in w just in case it is **true** in w.

- Then the existential presupposition of *whether-verbs can be formulated as follows.

(41) **The existential presupposition of *_whether_-verbs**
A *_whether_-verb triggers the presupposition that every property highlighted by its complement clause is satisfiable in the world of evaluation.

- To illustrate this, consider again Karttunen's example:

(42) It is amazing what they serve for breakfast.

- In this case, the embedded _wh_-question highlights a 1-place property:

(43) $\lambda x.\lambda w.\text{they-serve-for-breakfast}(x)(w)$

- The presupposition triggered by _amaze_ is that this highlighted property is satisfiable in the world of evaluation, i.e., that something is served for breakfast.

- This is exactly the existential requirement observed by d'Avis (2002).

- Notice that the definition in (41) requires that **every** property that is highlighted by the complement clause (rather than, say, _at least one_ of these properties) should be satisfiable in the world of evaluation.

- To justify this, we have to consider a somewhat more complex case.

(44) It is amazing what they serve for breakfast and what they serve for lunch.
⤳ Presupposition: they serve sth for breakfast and they serve sth for lunch

- Assuming that the conjunctive embedded clause in (44) highlights two 1-place properties, each contributed by one of the _wh_-clauses, the observed presupposition is predicted by (41).

- It is crucial in this case that **every** property highlighted by the complement clause is required to be satisfiable, rather than just one of these properties.[10]

Entries for _surprise_ and _realize_

- We consider _surprise_ and _realize_ as two concrete representatives of the class of *_whether_-verbs, and assume the following semi-formal entries for them.[11]

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[10]One may perhaps be tempted to object to this argument by suggesting that (44) may actually be seen as an elided version of (i) below, where conjunction does not apply to the interrogative complement clauses but rather to the declarative root clauses (the part that must be elided in order to obtain (44) is displayed in gray).

(i) It is amazing what they serve for breakfast and it is amazing what they serve for lunch.

One may suspect that, under this analysis, it is possible to derive the conjunctive presupposition of (44) even if the positive answer presupposition associated with verbs like _amaze_ just requires that at least one of the properties (rather than every property) highlighted by the complement clause be satisfiable. We refer to Herbstritt _et al._ (2015) for an argument that this is not the case.

[11]I diverge here slightly from the entries given in Herbstritt _et al._ (2015), in an attempt to make a clearer connection between the existential presupposition and the other components of the entries. In any case, while these entries are sufficient for our current purposes, I do by no means want to claim that

(45)   **Surprise**

Presupposition. The truth value of a sentence of the form φ *surprises* x is only defined in a world w if:

1. Every property highlighted by φ is **satisfiable** in w;
2. For every property P highlighted by φ and every tuple t such that $P(t)$ is true in w, x **believes** in w that $P(t)$ is true.

Assertion. A sentence of the form φ *surprises* x is true in w if and only if the above two conditions are fulfilled and, moreover, for every property P highlighted by φ there is a tuple t such that $P(t)$ is true in w and $P(t)$ is **incompatible with x's prior expectations** in w.

(46)   **Realize**

Presupposition. The truth value of a sentence of the form x *realizes* φ is only defined in a world w if:

1. Every property highlighted by φ is **satisfiable** in w;
2. For every property P highlighted by φ there is a tuple t such that $P(t)$ is true in w and $P(t)$ is **incompatible with x's prior beliefs** in w.

Assertion. A sentence of the form x *realizes* φ is true in w if and only if the above two conditions are fulfilled and, moreover, for every property P highlighted by φ and every tuple t such that $P(t)$ is true in w, x **believes** in w that $P(t)$ is true.

- Notice that the entries do not assume that the complement is a **question**, they apply just as well if the complement is a **declarative**.

- With these entries in place, we are now ready to return to the *whether puzzle.

Back to the *whether puzzle

- When *surprise* and *realize* take a **wh-question** as their complement, the requirement that every property highlighted by the complement be satisfiable generates an **existential presupposition**, as desired.

- But what if the complement is a **polar question** or an **alternative question**?

- First consider a polar question:

(47)   *It surprises Bill whether Susan is drinking coffee.

- The embedded question highlights a 0-place property, i.e., a proposition, namely the proposition 'that Susan is drinking coffee'.

- The verb presupposes that this property is **satisfiable** in the world of evaluation.

- Since the property is 0-place, this means that it simply has to be **true**.

they are completely realistic. Various refinements have been suggested in recent work of George (2011), Theiler (2014), Spector and Egré (2015), and Uegaki (2015), among others. We do not implement such refinements here because they address issues that are orthogonal to our main concern, and we want to keep the presentation as transparent as possible.

- So the verb contributes the presupposition that Susan is drinking coffee.

- As a consequence, (47) is equivalent to (48), which has a **declarative complement**:

  (48)   It surprises Bill **that** Susan is drinking coffee.

- This equivalence does not rely on any specific feature of our example; it occurs **systematically**, due to the existential presupposition of *surprise*.

- Declarative complements are **less complex** than polar interrogative complements in terms of processing (the latter involve an operation that adds an additional alternative to the meaning of the complement).

- As a result, they are **more likely to be interpreted as intended**.

- We propose that this explains why *whether-verbs do not license polar interrogative complements.[12]

- Now let's turn to the case of **alternative questions**.

  (49)   *It surprises Bill whether Susan is drinking coffee or tea.

- Now the embedded question highlights two 0-place properties, i.e., two propositions, namely 'that Susan is drinking coffee' and 'that Susan is drinking tea'.

- The verb presupposes that both of these properties are **satisfiable** in the world of evaluation.

- Since the properties ar 0-place, this just means that they have to be **true**.

- So the verb contributes a presupposition that **Susan is drinking coffee and tea**.

- From here we can proceed in one of two ways:

  1. It is quite generally assumed that alternative questions by themselves, i.e., independently of the embedding verb, contribute a presupposition that **exactly one of the listed alternatives holds**.

     In our example, this is the presupposition that **Susan is drinking either coffee or tea**, but **not both**.

     This is **incompatible** with the presupposition generated by the verb.

  2. If we do not want to rely on any specific assumption about the presuppositions of alternative questions, we can still account for the incongruence of (49), by pointing out that this sentence comes out equivalent to (50), with a **declarative** complement:

     (50)   It surprises Bill **that** Susan is drinking coffee **and** tea.

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[12]Our account is compatible with the view that the infelicity of polar interrogatives under *whether-verbs is highly grammaticalized. It may be that the competition with declarative complements has been the driving force behind this grammaticalization process diachronically, while no longer playing a role in the actual processing of these constructions synchronically.

Then we could argue as in the case of polar questions, that alternative questions are ruled out under *whether*-verbs through competition with declarative complements.

4 Conclusion

- The idea that sentences introduce **discourse referents**, which may serve as antecedents for subsequent anaphoric expressions, has been very fruitful in accounting for phenomena involving anaphora.

- We considered a somewhat more general notion, namely that sentences **highlight** certain semantic objects, i.e., make them particularly **salient**.

- One consequence of highlighting a certain semantic object is that it may become available as antecedent for subsequent anaphoric expressions.

- But in principle there may be other consequences as well.

- Our main question, then, was whether the notion of highlighting may be fruitfully applied **beyond the domain of anaphora**.

- We considered two phenomena:

  1. Dependency implicatures of response questions.
  2. Selectional restrictions of question-embedding verbs: the *whether*-puzzle.

- In both cases, taking highlighting into account proved **very useful**.

- Of course, we have **not** shown that it is **impossible** to account for these phenomena **without** taking highlighting into account.

- Indeed, alternative approaches are being pursued as we speak (see in particular Groenendijk 2015 on response questions and Romero 2015 on the *whether*-puzzle).

- However, I hope to have made a convincing case that an account of these phenomena that exploits differences in highlighting between the various question types is worth taking into serious consideration.

- Moreover, I hope that the two presented case-studies are suggestive of a much broader range of phenomena where highlighting may play an important role.

  (Some such phenomena are briefly illustrated in the appendix.)

- Finally, if the given account of the *whether*-puzzle is on the right track, then this suggests that highlighting cannot be treated as an aspect of meaning that lives its life quite separately from truth-conditions and resolution-conditions, but rather that it is strongly **intertwined** with these other aspects of meaning.

A Some other potentially relevant phenomena

Ignorance implications of rogative verbs

- Rogative verbs are verbs that take questions as their complement, but not declarative clauses.

- Examples: *wonder, investigate, be curious, inquire into, examine, ask.*

  (51) a. Bill wonders who Mary voted for.
        b. *Bill wonders that Mary voted for Albright.

- In Ciardelli and Roelofsen (2015), a semantics for *wonder* is given that explains this selectional restriction.

- The account exploits the fact that (51a) implies that Bill is **ignorant** as to who Mary voted for.

- This seems to be a general feature of *wonder*, and also of other rogative verbs like *investigate* and *be curious* (the only exception, as far as I'm aware, is *ask*).

- Thus, the account given in Ciardelli and Roelofsen (2015) could be applied to these other rogative verbs as well.

- Once we start looking at this ignorance component of rogative verbs in more detail, however, an interesting observation can be made which remains unexplained by the account in Ciardelli and Roelofsen (2015).

- Namely, when the complement of the verb is an **alternative question**, the ignorance implication is particularly strong, **stronger than** with **wh-questions**.

- Consider the following example:

  (52) *Context: There is an election with three candidates, A, B, and C. Mary voted. Bill knows that Mary did not vote for C, but he doesn't know for which candidate she did vote, and he wants to know.*
        a. Bill wonders who Mary voted for.   TRUE
        b. Bill wonders whether Mary voted for A, B, or C.   FALSE

- The embedded questions in (52a) and (52b) have exactly the **same resolution conditions**.

- How can it be, then, that (52a) is true in the given context and (52b) false?

- It seems to matter that in (52b), unlike in (52a), the three alternatives are all **highlighted**.

- It seems that a sentence of the form x *wonders* Q can only be true if x considers all the alternatives highlighted by Q possible.

- Should this ignorance implication really be encoded in the **semantics** of *wonder*?

- Perhaps it could be derived **pragmatically**, either as a **quantity implicature** or as a **manner implicature**.

- For instance, in the context above, it may be possible to argue that it would have been more informative / more perspicuous to say (53) than (52b):

(53)   Bill wonders whether Mary voted for A or B.

- Whether such an account can be made to work for this particular example depends on what exactly we take the semantics of *wonder* to be.

- But, even if this can be made to work, for other examples a pragmatic approach does not seem feasible. For instance:

(54)   *Context: There has been a crime and there are three suspects, A, B, and C. A team of 20 detectives is investigating the case. Initially, they all consider A, B, and C potential culprits. But at some point two detectives gather some evidence which leads them to exclude C as a suspect. The other detectives have not heard about this yet.*

        Exactly 18 detectives still wonder whether A, B, or C did it.   TRUE

- If the ignorance implication is not built into the semantics of *wonder*, it will be very hard to avoid the prediction that (54) has a reading on which it is *false* in the given scenario, contrary to intuition.

- I am investigating this issue in more depth in ongoing work with Wataru Uegaki.

Contextual restrictions on the use of polar questions

- This section is based on Roelofsen and Farkas (2015, §6).

- There are many ways to ask a question that elicits a choice between two complementary alternatives. E.g., if we want to know whether Bill left we can ask:

(55)   a.   Did Bill leave?
        b.   Did Bill not leave?
        c.   Didn't Bill leave?
        d.   Did Bill leave or not?
        e.   Bill left, didn't he?
        f.   Bill left?

- I will only be concerned here with questions like (55a) and (55b), which I will refer to as **unmarked** polar questions.

- There are certain **contextual restrictions** on the felicitous usage of such polar questions, which have received considerable attention in the recent literature (Büring and Gunlogson, 2000; van Rooij and Šafářová, 2003; Romero and Han, 2004; AnderBois, 2011; Roelofsen *et al.*, 2012, among others).

- Several mutually inconsistent generalizations have been proposed.

- Further experimental work is needed to firm the empirical ground, but we suggest that there is at least one **core generalization** that is quite robust.

- In formulating it, we use α_Q to denote the unique alternative that is **highlighted** by an unmarked polar question Q.

  (56)   *Felicity condition for unmarked polar questions*
  An unmarked polar question Q is only felicitous if there is no compelling contextual evidence against α_Q.

- This condition encompasses a number of earlier generalizations. For instance, Büring and Gunlogson (2000) suggest the following generalization concerning *positive* polar questions like (55a) (rephrased here using our own terminology).

  (57)   *Felicity cond. for positive polar questions*   (Büring and Gunlogson, 2000)
  A positive polar question Q is felicitous only if there is no compelling contextual evidence against α_Q.

- Clearly, (57) is a special case of (56), specifically concerned with positive polar questions. Büring and Gunlogson motivate (57) with the following two examples.

  (58)   Scenario: *A enters S's windowless computer room wearing a dripping wet raincoat.*
  a.   S: What's the weather like out there? Is it raining?
  b.   S: #What's the weather like out there? Is it sunny?

  (59)   Scenario: *A and S have conducted a psycholinguistic experiment in which the subjects all certified that they are right-handed. They encounter Carl, who they recognize as one of their subjects, cutting bread with his left hand.*
  a.   S: Is Carl left-handed?
  b.   S: #Is Carl right-handed?

- The example in (59) shows that immediate contextual evidence overrules previous beliefs of the speaker and the addressee in determining whether a polar question is felicitous or not.

- As for negative polar questions like (55b), Büring and Gunlogson (2000) propose the generalization in (60):

  (60)   *Felicity cond. for negative polar questions*   (Büring and Gunlogson, 2000)
  A negative polar question Q is felicitous only if there is compelling contextual evidence for α_Q.

- This condition is not a special instance of our generalization in (56).

- According to (56), a negative polar question Q is felicitous only if there is *no* compelling contextual evidence *against* α_Q.

- But this does not mean that there must be contextual evidence *for* α_Q, as required by (60).

- Büring and Gunlogson motivate their generalization with the following examples.[13]

  (61)   Scenario: *S is visiting A in his home town. S and A want to have dinner.*

    a.   A: Since you are vegetarian, we can't go out in this town, where it's all meat and potatoes.
    S: Is there no vegetarian restaurant around here?

    b.   A: I bet we can find any type of restaurant that you can think of in this city. Make your choice!
    S: # Is there no vegetarian restaurant around here?

    c.   A: Where would you like to go for dinner?
    S: # Is there no vegetarian restaurant around here?

- Notice that in (61a) there is evidence **for** α_Q, in (61b) there is evidence **against** α_Q, while (61c) involves a **neutral** context relative to α_Q.

- These examples, then, indeed point in the direction of Büring and Gunlogson's generalization.

- However, van Rooij and Šafářová (2003) argue that (60) is **too strong**, based on the following examples:

  (62)   *On the website of a bank:*

    Have you not been able to receive credit from your financial institution to back up your business activities? Then click this button.

  (63)   *Context: Someone visits her doctor with her son.*

    Doctor: Has he not been eating properly?

- In both of these cases, the context is presumably neutral relative to α_Q.

- Thus, it appears that negative polar questions are not always infelicitous in a neutral context, which means that Büring and Gunlogson's generalization is too strong.

- The generalization in (56) is *not* contradicted by van Rooij and Šafářová's examples.

- This, then, seems to be the core generalization that needs to be accounted for.

- In Roelofsen and Farkas (2015, §6) such an account is proposed, relying on the assumption that a speaker's choice between the various question forms is partly determined by the type of responses that the context leads her to anticipate.

- The details of the account are not relevant here.

- What is important is that the generalization as we formulated it makes crucial reference to the alternative that is **highlighted** by the question at hand.

- This, then, is another area where highlighting seems to play an important role.

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[13]In these examples it is assumed that *no* is an indefinite determiner that occurs in the scope of a covert sentential negation operator (see, e.g., Zeijlstra, 2004; Penka, 2011; Brasoveanu *et al.*, 2013, for theoretical and experimental work supporting this assumption). Thus, the polar question featuring in these examples is taken to be a negative polar question.

Questions with doomed alternatives

- Consider the following contrast:

  (64) A: Is Peter coming for dinner tonight?
        B: Is he in town this week?

  (65) A: Is Peter coming for dinner tonight?
        B: #Is he out of town this week?

- This contrast is striking because the response questions in (64) and (65) are equivalent in terms of resolution conditions.

- Both questions elicit a choice between two alternatives: 'in town' and 'out of town'.

- But they differ in highlighting: the first highlights the 'in town' alternative, the second highlights the 'out of town' alternative. Apparently this matters.

- The contrast is perhaps even more marked if we insert the particle *even* (see Iatridou and Tatevosov, 2015, for discussion of this use of *even* in polar questions):

  (66) A: Is Peter coming for dinner tonight?
        B: Is he even in town this week?

  (67) A: Is Peter coming for dinner tonight?
        B: #Is he even out of town this week?

- Notice that from A's question, B can infer that *if* Peter is out of town, then A would not be able to confirm this—otherwise she would not have asked whether he is coming for dinner.

- So, if A can answer B's response question, the answer must be that Peter is **in town**.

- We could say that the 'out of town' alternative in B's question is **doomed**.

- These examples suggest the following **preliminary generalization**:

  If a speaker asks a question Q and one of the alternatives in $[\![Q]\!]$ is doomed, i.e., it can be inferred in the context of utterance that the addressee will not be able to confirm it, then the speaker should not highlight this alternative.

- But the following response questions are fine:

  (68) A: Is Peter coming for dinner tonight?
        B: Isn't he out of town this week?

  (69) A: Is Peter coming for dinner tonight?
        B: He is out of town this week, isn't he?

- Assuming that these questions highlight the 'out of town' alternative, these are counterexamples to our preliminary generalization.

- Interestingly, a rising declarative highlighting the 'out of town' alternative is again infelicitous:

  (70)   A: Is Peter coming for dinner tonight?
          B: #He is out of town this week?

- In Farkas and Roelofsen (2015) it is argued based on similar contrasts between rising declaratives and tag questions that, while both signal that the speaker is biased towards the highlighted alternative, rising declaratives indicate that the speaker only has weak evidence supporting this bias, if any evidence at all, while tag questions signal that the speaker has moderate to strong evidence.

- It is often assumed that high negation questions also signal that the speaker is biased towards the highlighted alternative. It seems reasonable to assume that the speaker's evidence in this case must be moderate to strong, as in the case of tag questions.

- This, then, leads to the following **revised generalization**:

  If a speaker asks a question Q and one of the alternatives in $[\![Q]\!]$ is doomed, then she should only highlight this alternative if she has moderate to strong evidence for it, and in this case the form of the question should signal that she has such evidence.

- One would of course like to be able to derive this generalization from more basic principles, but this must be left for another occasion.

- This may also shed light on some of the issues that Iatridou and Tatevosov (2015) raise about the role of *even* in polar questions.

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