Question meaning as resolution conditions

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Declaratives

- To know the meaning of a declarative sentence is to know what has to be the case for the sentence to be true.
- Declarative meaning = truth conditions.

Interrogatives (standard view)

- To know the meaning of an interrogative sentence is to know what counts as a basic semantic answer.
- Interrogative meaning = answerhood conditions.

Declaratives

- To know the meaning of a declarative sentence is to know what has to be the case for the sentence to be true.
- Declarative meaning = truth conditions.

Interrogatives (proposal)

- To know the meaning of an interrogative sentence is to know what information is needed to resolve it.
- Interrogative meaning = resolution conditions.

G&S on explanatory adequacy

[...] It seems natural to require of a semantic theory that deals with a certain domain of phenomena, that it account for such phenomena as they occur elsewhere too, by using general principles, notions and operations which can be applied outside the particular domain of the theory as well.

Studies on the semantics of questions and the pragmatics of answers, p. 11

G&S on explanatory adequacy and entailment

An example of a relation which can be found in every descriptive domain is the relation of entailment. [...]

Descriptive adequacy requires only that the analysis give a correct account of whatever entailments hold in its descriptive domain.

But explanatory adequacy is achieved if this account is based on a general notion of entailment, one that applies in other domains equally well.

In fact, the semantic framework one uses brings along a general definition of entailment. For example, if the framework is based on set-theory, entailment will basically be inclusion.

Hence, whenever some analysis in this framework is to account for the fact that one expression entails another, it should do so by assigning them meanings in such a way that the meaning of the one is included in the meaning of the other.

Interrogative entailment

"It seems natural to consider one interrogative entailing another as every proposition giving an answer to the first gives an answer to the second."

Example

(1) a. Who went to the party and who went to the cinema?
    b. Who went to the party?
    c. Did John go to the party?

Question (1-a) entails (1-b), which in turn entails (1-c).
Hence, to satisfy G&S requirement, we should have:

$$[\![(1\text{-a})]\!] \subseteq [\![(1\text{-b})]\!] \subseteq [\![(1\text{-c})]\!]$$

G&S on explanatory adequacy and coordination

Another example that illustrates this point is provided by the operations of coordination. Coordination, too, is to be found in all kinds of categories.

Hence, the explanatory power of an analysis that deals with coordinations of expressions of some particular category is greatly enhanced if the account it gives is based on general semantic operations associated with the coordination processes.

Again, the semantic framework defines these operations. If the framework is based on set theory, conjunction and disjunction of expressions in whatever category will have to be interpreted as intersection and union, respectively.

Example

(2) a. Where is your father?
b. Where is your mother?
c. Where is your father, and where is your mother?
d. Where is your father, or where is your mother?

To satisfy G&S's requirements, we should have:

$$[\![(2\text{-c})]\!] = [\![(2\text{-a})]\!] \cap [\![(2\text{-b})]\!]$$

$$[\![(2\text{-d})]\!] = [\![(2\text{-a})]\!] \cup [\![(2\text{-b})]\!]$$

- In the theories of Hamblin, Karttunen, Bennett and Belnap, the meaning of an interrogative is a set of propositions.
- These propositions are regarded as the basic semantic answers.
- But then, on each of these theories, $[\![(3\text{-a})]\!] \not\subseteq [\![(3\text{-b})]\!]$.

  (3) a. Who went to the party?
      b. Did John go to the party?

- Thus, in these approaches, interrogative entailment cannot amount to meaning inclusion.

- Moreover, on each theory the sets $[\![(4\text{-a})]\!]$ and $[\![(4\text{-b})]\!]$ are disjoint.

(4) a. Who went to the party?
    b. Who went to the cinema?

- If conjunction amounts to intersection, we predict $[\![(5)]\!] = \emptyset$.

(5) Who went to the party and who went to the cinema?

- So, on these approaches, conjunction cannot amount to intersection.

- (In fact, it is hard, or even impossible, to define satisfactory notions of entailment and conjunction for these meanings.)

G&S conclusion

"These considerations clearly indicate that the Karttunen framework simply assigns the wrong type of semantic object to interrogatives."

Questioning this conclusion

- Prop-set theories have troubles with entailment and coordination.
- This observation relies on two assumptions:
  - A1 the meaning of an interrogative is a set of propositions
  - A2 the propositions in this set are the basic semantic answers
- G&S identify A1 as the culprit.
- Claim1: A1 is compatible with G&S requirements if we drop A2.
- Claim2: dropping A1 constrains our theory unnecessarily.

- Let us call $\text{Res}(\mu)$ the set of propositions that resolve μ.
- E.g., if $?\alpha$ denotes a polar interrogative :

$$\text{Res}(?\alpha) = \{p \mid p \subseteq [\![\alpha]\!] \text{ or } p \subseteq [\![\text{not } \alpha]\!]\}$$

- On the one hand, recall the definition of interrogative entailment: $\mu \models \nu$ iff every proposition that resolves μ also resolves ν.

$$\mu \models \nu \iff \text{Res}(\mu) \subseteq \text{Res}(\nu)$$

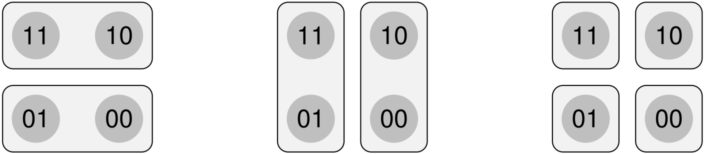
- On the other, we require that entailment amount to meaning inclusion:

$$\mu \models \nu \iff [\![\mu]\!] \subseteq [\![\nu]\!]$$

- Obvious solution: $[\![\mu]\!] := \text{Res}(\mu)$

Conjunction

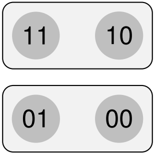
- p resolves (μ and ν) $\iff$ p resolves μ and p resolves ν.
- Hence, $\text{Res}(\mu \text{ and } \nu) = \text{Res}(\mu) \cap \text{Res}(\nu)$.
- So, if $[\![\mu]\!] = \text{Res}(\mu)$, conjunction amounts to meaning intersection.



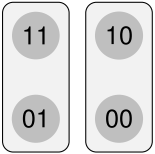
(a) $?p$ (b) $?q$ (c) $?p$ and $?q$

Disjunction

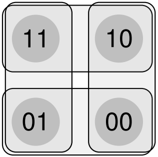
- p resolves $(\mu$ or $\nu) \iff p$ resolves μ or p resolves ν.
- Hence, $\text{Res}(\mu \text{ or } \nu) = \text{Res}(\mu) \cup \text{Res}(\nu)$.
- So, if $[\![\mu]\!] = \text{Res}(\mu)$, disjunction amounts to meaning union.



(d) $?p$



(e) $?q$



(f) $?p$ or $?q$

The type is not the culprit!

- Satisfying G&S's requirements is perfectly compatible with having question meanings $[\![\mu]\!]$ which are sets of propositions.
- However, the propositions in $[\![\mu]\!]$ should not be the basic semantic answers to μ, but the resolving bodies of information for μ.

Issues

- Now, what sort of object is $[\![\mu]\!]$ in this approach?
- A set of propositions.
- But not any set qualifies as a suitable question meaning.
- Crucially, if $p \in [\![\mu]\!]$ and $q \subseteq p$, then $q \in [\![\mu]\!]$.
- We say that $[\![\mu]\!]$ must be downward closed.
- In inquisitive semantics, a downward closed set of propositions is called an issue.

The algebraic perspective

The space $(\mathcal{I}, \subseteq)$ of issues ordered by entailment has a natural algebraic structure:

- $I_1 \cap I_2$ is the meet (greatest lower bound) of I_1 and I_2;
- $I_1 \cup I_2$ is the join (least upper bound) of I_1 and I_2;
- and more... (Heyting algebra, see Roelofsen 2013)

Coordination

This allows a treatment of coordination that is natural in two ways:

- type-theoretically, they are the standard operations of generalized conjunction and disjunction;
- algebraically, they are fundamental operations, responsible for the logical properties of conjunction and disjunction.

The most general solution

Taking $[\![\mu]\!] = \mathsf{Res}(\mu)$ is not only the simplest, but also the most general way to satisfy G&S's requirements.

Proposition

Take any semantics $[\![\cdot]\!]$ which satisfies: $\mu \models \nu \iff [\![\mu]\!] \subseteq [\![\nu]\!]$

Let Q be the space of designated question meanings.

Then the map:

$$[\![\mu]\!] \mapsto \mathsf{Res}(\mu)$$

is an embedding from $(Q, \subseteq)$ to the space $(\mathcal{I}, \subseteq)$ of issues.

Embedding partition semantics in issue semantics

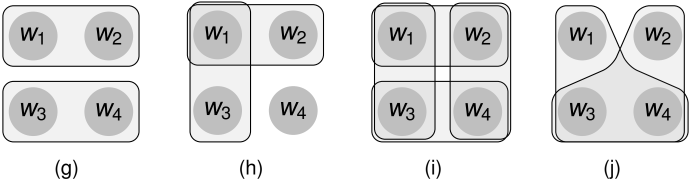
- For G&S, $[\![\mu]\!]$ is an equivalence relation $\sim_\mu$ on possible worlds.
- $w \sim_\mu w'$ in case the complete answer to μ is the same in w and w'.
- A proposition p resolves μ in case: $\forall w, w' \in p,\ w \sim_\mu w'$.
- Thus, partition semantics can be embedded in issue semantics by identifying the equivalence relation $\sim_\mu$ with the issue:

$$\text{Res}_{\sim_\mu} = \{\, p \mid \forall w, w' \in p,\ \ w \sim_\mu w' \}$$

- Hence, partition semantics is a special case of issue semantics.

Issue semantics is strictly more general

- However, the converse is not the case.
- Only some issues correspond to equivalence relations, namely, those whose maximal elements form a partition of the logical space.
- For, G&S solution works under the unique answer assumption.
- Non-partition issues provide meanings for non-unique answer questions.

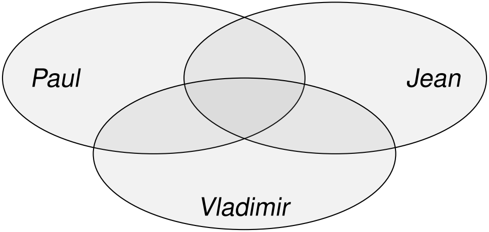


Mention-some questions

(6) What is a typical French name?

Resolution conditions

- p resolves (6) $\iff$ $p \subseteq [\![x \text{ is a typical French name}]\!]_{x \mapsto d}$ for some d
- $\text{Res}(6) = \{p \mid \exists d, p \subseteq [\![x \text{ is a typical French name}]\!]_{x \mapsto d}\}$

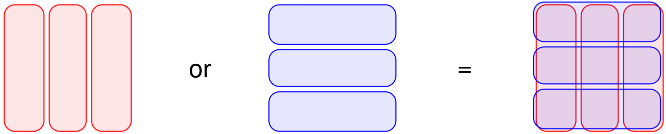


Choice questions

(7) a. Where is your mother, or your father?
b. Where do two unicorns live?

Resolution conditions

- p resolves (7-a) $\iff$ $p \in \text{Res}(\text{where is your father?}) \cup \text{Res}(\text{where is your mother?})$
- p resolves (7-b) $\iff$ $\exists d \neq d'$ such that:
  - $p \subseteq [\![d \text{ is a unicorn}]\!] \cap [\![d' \text{ is a unicorn}]\!]$
  - $p \in \text{Res}(\text{where does } d \text{ live?}) \cap \text{Res}(\text{where does } d' \text{ live?})$



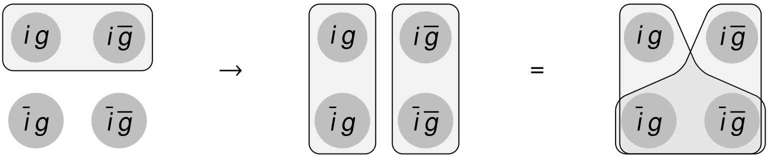
Conditional questions

(8) If John invites Mary to the party, will she go?

Resolution conditions

p resolves (8) $\iff$

$p \cap [\![\text{John invites Mary}]\!] \in \text{Res(will Mary go?)}$



Wrapping up

- Proposal: identify question meaning with resolution conditions.
- Resolution conditions are encoded by an issue:
  a downward closed set of propositions.
- Like G&S, we give a principled account of interrogative meaning:
  - natural entailment order
  - natural coordination operations
- This is the most general notion of meaning compatible with these requirements.
- In particular, we are not confined to unique answer questions:
  we can deal with mention-some, choice, and conditional questions.
- Thus, we combine the conceptual and formal advantages of G&S's approach with the greater generality of proposition-set approaches.


THANK
YOU
GRACIAS
ARIGATO
SHUKURIA
DANKSCHEEN
TASHAKKUR ATU
YAQHANYELAY
SUKSAMA
EKHMET
GRAZIE
MEHRBANI
PALDIES
MAAKE
KOMAPSUMNIDA
GOZAIMASHITA
EFCHARISTO
JUSPAXAR
BOLZÏN
MERCI
BÏYAN
SHUKRIA
TINGKI

Appendix A: answerhood and alternatives

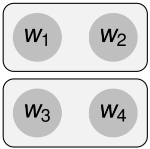
Answerhood

- Issue semantics does not take basic semantic answerhood to be the fundamental notion of question semantics.
- But this does not mean that it has nothing to say about answerhood.
- BSA may be characterized as “answers with neither too much nor too little information”. (Belnap)
- We can read this as: p is a BSA for μ in case the information is contains is:
  - not too little, i.e., enough to resolve μ;
  - not too much, i.e., not more than necessary to resolve μ.
- In this characterization, BSAs are minimal resolving propositions.

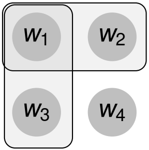
  $\text{BSA}(\mu) = \{p \mid p \in \text{Res}(\mu)$ and there is no $q \supset p$ such that $q \in \text{Res}(\mu)\}$

Alternativehood

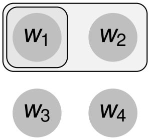
- We say that two propositions p, q are alternative if $p \not\subseteq q$ and $q \not\subseteq p$.
- Fact: a set P of propositions is the set of BSAs of some issue
  iff every $p, q \in P$ are alternative.
- Thus, defining BSAs as above gives us a notion which is
  - less constrained than in G&S (partitions)
  - more constrained than in prop-set theories (arbitrary sets)
- E.g., (k) and (l) would be the set of BSAs of some issue, but not (m).



(k)



(l)



(m)

- One may think that this restriction is problematic in view of alternative questions such as (9).

  (9) Did John invite Ann, or Sue, or both?

- In fact, the more restricted notion of meaning turns out to be advantageous precisely in these cases.

- Let us see why.

- In most cases, alternative questions in which one disjunct entails another are infelicitous.

(10) a. Is Fido a cat, a dog, or a spaniel?
b. Is John's wife Asian or Chinese?
c. Did Mary wear a scarf, or a red scarf?

- However, in some cases, such questions are perfectly alright.

(11) a. Did John invite Ann, or Sue, or both?
b. Did Mary read some of these books, or all of them?

- We would like to explain why (10-a-c) are infelicitous, and why (11-a,b) are fine.

- Assume p resolves an alternative question $AQ(\alpha_1, \ldots, \alpha_n)$ just in case p establishes one of $\alpha_1, \ldots, \alpha_n$.

$$\text{Res}(AQ(\alpha_1, \ldots, \alpha_n)) = \{\, p \mid p \subseteq [\![\alpha_n]\!] \text{ for some } n \,\}$$

- Suppose α_{n+1} entails α_n, i.e., $[\![\alpha_{n+1}]\!] \subseteq [\![\alpha_n]\!]$
- Then $p \subseteq [\![\alpha_n]\!]$ or $p \subseteq [\![\alpha_{n+1}]\!] \iff p \subseteq [\![\alpha_n]\!]$
- So, $\text{Res}(AQ(\alpha_1, \ldots, \alpha_{n+1})) = \text{Res}(AQ(\alpha_1, \ldots, \alpha_n))$.
- That is, $AQ(\alpha_1, \ldots, \alpha_{n+1})$ is equivalent to $AQ(\alpha_1, \ldots, \alpha_n)$
- The disjunct α_{n+1} would thus be redundant, and a speaker uttering $AQ(\alpha_1, \ldots, \alpha_{n+1})$ would violate the maxim of manner.
- This explains why (10-a-c) are infelicitous.

- But then, why are (11-a,b) fine?

- The first disjuncts in (11), unlike those in (10), naturally admit an exhaustive interpretation:
  - John invited Ann $\rightsquigarrow$ not Sue
  - Mary read some books $\rightsquigarrow$ not all
  - Fido is a dog $\not\rightsquigarrow$ not a Spaniel
  - John's wife is Asian $\not\rightsquigarrow$ not Chinese

- If the first two disjuncts in are interpreted exhaustively, the third disjunct is no longer redundant, which explains why (11) is fine.

- And, indeed, to resolve (11-a), it is not sufficient to establish that John invited Ann: one should establish either only Ann, or both.

So, we get answers to the following two questions.

- Q When is an alt. question with a disjunct entailing another felicitous?
- A When the weak disjuncts admit an exhaustive re-interpretation that brakes the entailment.

- Q Why this constraint?
- A In the absence of exhaustive re-interpretation, the stronger disjunct would be redundant, and the question would violate manner.

Appendix B: extensions and intensions

- How to cast the proposal in a Fregean setup?
- We have (at least) two options to define extensions.
  1. à la Hamblin: $[\![\mu]\!]_w = \text{Res}(\mu)$
  2. à la Karttunen: $[\![\mu]\!]_w = \{p \in \text{Res}(\mu) \mid w \in p\}$
- In either case, we have:
  - the intension $[\![\mu]\!] : w \mapsto [\![\mu]\!]_w$ and the set $\text{Res}(\mu)$ determine each other.
  - $[\![\mu]\!] \subseteq [\![\nu]\!] \iff (\text{for all } w, [\![\mu]\!]_w \subseteq [\![\nu]\!]_w) \iff \text{Res}(\mu) \subseteq \text{Res}(\nu)$
  - $[\![\mu]\!] \cap [\![\nu]\!] \quad = \quad w \mapsto ([\![\mu]\!]_w \cap [\![\nu]\!]_w) \quad = \quad \text{Res}(\mu) \cap \text{Res}(\nu)$
  - $[\![\mu]\!] \cup [\![\nu]\!] \quad = \quad w \mapsto ([\![\mu]\!]_w \cup [\![\nu]\!]_w) \quad = \quad \text{Res}(\mu) \cup \text{Res}(\nu)$
- So, in either case we can safely identify $[\![\mu]\!]$ with $\text{Res}(\mu)$.

Appendix C: issues without minimal resolving props

- For (12) there is no minimal resolving proposition.

(12) What is an amount of money that you are not allowed to carry across the border?

- This relies on the fact that properties of numbers are necessary.
- This has other repercussions. E.g., in any propositional semantics, (13) has only one possible answer, the tautological proposition.

(13) What is the product of 7 and 3?

- Possible answers are answers that are true in some possible worlds.
- To get the “wrong” answers as well, we must admit impossible worlds, i.e. worlds where logical facts are different.
- This would also solve our problem with (12).