Question meaning=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 an 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.

Guidelines from Groenendijk and Stokhof

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

Guidelines from Groenendijk and Stokhof

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.

Guidelines from Groenendijk and Stokhof

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."

For instance, (1-a) entails (1-b), which in turn entails (1-c).

(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?

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

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

Guidelines from Groenendijk and Stokhof

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.

Guidelines from Groenendijk and Stokhof

Coordinated interrogatives

(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:

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

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

The argument against proposition-set theories

- 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 to the question.
- 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.

The argument against proposition-set theories

- 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 very hard to define *any* principled notion of conjunction for these meanings.)

The argument against proposition-set theories

- G&S conclude that “these considerations clearly indicate that the Karttunen framework simply assigns the wrong type of semantic object to interrogatives.”
- “One would rather expect the type of interrogative denotations to be that of propositions, instead of sets of propositions”.
- Clearly, proposition-set theories have a problem with entailment and coordination.
- But is it right to blame it on the type?

Satisfying G&S's requirements

- Let us call $\text{Res}(\mu)$ the set of propositions that resolve μ.
- E.g., if α is a declarative and $?\alpha$ is the corresponding polar interrogative: $\text{Res}(?\alpha) = \{p \mid p \subseteq [\![\alpha]\!] \text{ or } p \subseteq [\![\text{not } \alpha]\!]\}$
- On the one hand, we have 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, entailment should amount to meaning inclusion:

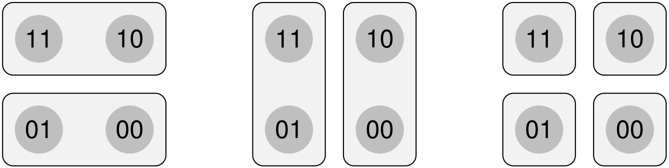
$$\mu \models \nu \iff [\![\mu]\!] \subseteq [\![\nu]\!]$$

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

Satisfying G&S's requirements

Conjunction

- This choice also satisfies G&S's requirement for coordination.
- 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.

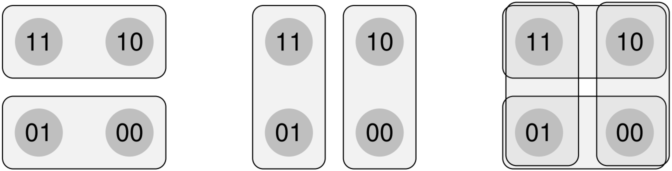


(a) $?p$ (b) $?q$ (c) $?p$ and $?q$

Satisfying G&S's requirements

Disjunction

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



(d) ?p (e) ?q (f) ?p or ?q

Satisfying G&S's requirements

The type is not the culprit!

- Satisfying G&S's requirements is perfectly compatible with having questions 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.

Satisfying G&S's requirements

- But wait, can we cast this in terms of extensions and intensions?
- 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 the following we can safely identify $[\![\mu]\!]$ with $\text{Res}(\mu)$.

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, we have called a downward closed set of propositions an issue.

Issues

The space $(\mathcal{I}, \subseteq)$ of issues ordered by inclusion 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)

These operations allow us to treat coordination in a way that is natural from two points of view:

- 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.

Issues

The most general solution

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

Proposition

Take any semantics $[\![\cdot]\!]$ defined in such a way that $\mu \models \nu \iff [\![\mu]\!] \subseteq [\![\nu]\!]$. Let $\mathcal{Q}$ be the space of designated question meanings. Then the map:

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

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

Issues

Embedding G&S semantics in issue semantics

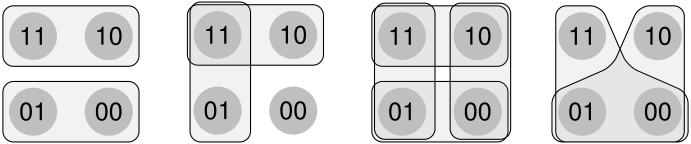
- This holds in particular for G&S's own proposal.
- For G&S, $[\![\mu]\!]$ is an equivalence relation $\sim_\mu$ on possible worlds.
- $w \sim_\mu w'$ in case the complete answer to μ is the same in w and w'.
- A proposition p resolves μ in case $\forall w, w' \in p$, $w \sim_\mu w'$.
- Thus, G&S semantics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

$$I_{\sim_\mu} = \{p \mid \forall w, w' \in p, w \sim_\mu w'\}$$

- And, entailments and conjunctions are preserved.

Non-unique answer questions

- 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.



(g) (h) (i) (j)

Non-unique answer questions

- Mention-some questions
  - What is a typical French name?
  - $\{p \mid \exists d, p \subseteq [\![d \text{ is a typical French name}]\!]\}$
- Choice questions: disjunction
  - Where is your father, or your mother?
  - $[\![\text{where is your father?}]\!] \cup [\![\text{where is your mother?}]\!]$
- Choice questions: indefinites
  - Where do two unicorns live?
  - $\{p \mid \exists d \neq d', p \subseteq [\![d \text{ is a unicorn}]\!] \text{ and } p \in [\![\text{where does } d \text{ live?}]\!] \text{ and}$
    $p \subseteq [\![d' \text{ is a unicorn}]\!] \text{ and } p \in [\![\text{where does } d' \text{ live?}]\!]\}$

Non-unique answer questions

- Conditional questions
  - If John asks Mary out, will she accept?
  - $\{p \mid p \cap [\![\text{John asks Mary out}]\!] \in [\![\text{will Mary accept?}]\!]\}$
- Which questions
  - Which students passed the test?
  - G&S's conjunctive analysis
    $\{p \mid \text{ for all } d, p \in [\![\text{is d a student who passed the test?}]\!]\}$
  - Velissaratou's conditional analysis
    $\{p \mid \text{ for all } d, p \cap [\![d \text{ is a student}]\!] \in [\![\text{did } d \text{ pass the test?}]\!]\}$

Answerhood

- The answerhood thesis (Belnap) is the requirement that the semantics of a question determine what counts as an answer to it.
- As G&S argue, this principle should be understood broadly:
  - first, the semantics of a question should qualify certain propositions as basic semantics answers (BSAs);
  - second, these basic semantic answers should form a good ground for a general theory of answerhood.
- BSAs are “answers with neither too much nor too little information” (Belnap).
- In this characterization, BSAs are minimal resolving propositions.
- Thus, BSAs are determined by resolution conditions:

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

Summing 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 approach with the greater generality of proposition-set approaches.


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

Appendix: embeddings

- In G&S, both *that*- and *wh*-complements denote propositions.
- This allows for a uniform account of verbs like *tell*, *know*, and *remember*, which embed both kinds of complements.
- Up to now we have assumed that the meaning of a declarative is a proposition, $[\![\alpha]\!] = \{w \mid w \models \alpha\}$.
- But it can also be taken to be (type-shiftable to) an issue, namely:

$$[\![\alpha]\!] = \{p \mid \forall w \in p, w \models \alpha\}$$

- Then a uniform account of verbs like *tell* and *know* can be given.
- E.g., if p_w is the set of worlds compatible with what a told b at w,

$$w \models a \text{ told } b\ \varphi \iff p_w \in [\![\varphi]\!]$$

Appendix: answerhood

A difficulty?

- For (6) there is no minimal resolving proposition.

(6) 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, (7) has only one possible answer, the tautological proposition.

(7) 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 (6).

Appendix: the distributivity test

- What we have outlined is an approach, not a specific theory.
- However, the approach indicates not only what kind of object $[\![\mu]\!]$ should be, but also how to determine what $[\![\mu]\!]$ should be.
- Distributivity test (Belnap): suppose $p = [\![\alpha]\!]$.
  To determine whether $p \in [\![\mu]\!]$, check wether the following holds:

  $$\text{Sally knows } \alpha \models \text{Sally knows } \mu$$

- Of course, deciding on a specific case may still be hard (especially when presuppositions are around).
- However, we feel that this task is still clearer than that of deciding what propositions count as "possible answer".