Is John *still* or *again* in Paris?

Presuppositions in inquisitive semantics

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Overview

Basic inquisitive semantics

- goal
- propositions and meanings
- the basic system
- assertions and questions

Inquisitive semantics with presuppositions

- motivation
- meanings with a presupposition
- a presuppositional system
- *still* or *again*: the system at work

The goal of inquisitive semantics

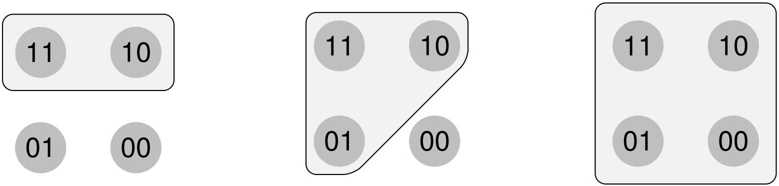
- Traditionally, meaning is identified with informative content
- When information is exchanged in conversation, sentences are not just used to provide information.
- Crucially, they are also used to request information.
- Inquisitive semantics aims at developing a more comprehensive notion of meaning which encompasses both:
    - informative content, the potential to provide information
    - inquisitive content, the potential to request information

Propositions and meanings: overview

- When a sentence φ is uttered in a context s, it expresses a proposition $s[\varphi]$, which embodies a proposal to change the context in certain ways.
- The proposition $s[\varphi]$ expressed by φ in a context s is determined by the meaning of the sentence.
- Thus, the meaning of a sentence φ is a function M_φ mapping contexts to propositions.
- But what exactly are contexts and propositions?

Information states

- An information state is a set of possible worlds.
- We say t is an enhancement of s in case $t \subseteq s$.
- We denote by ω the blank state, consisting of all worlds.
- A state may represent several things:
  1. a piece of information;
  2. the information state of a conversational participant;
  3. the state of the common ground of a conversation.
- We will take the context of a conversation to be a state, interpreted as the information state of the common ground.



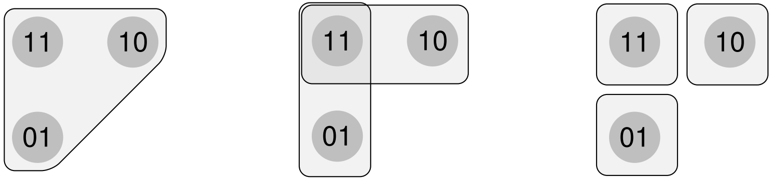
Issues

Definition

An issue over a state s is a set $\mathcal{I}$ of enhancements of s such that

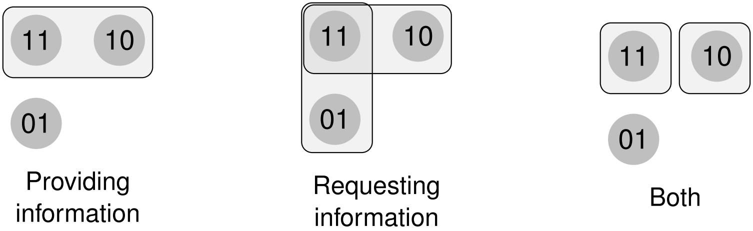
1. $\mathcal{I}$ is downward closed: if $u \subseteq t$ and $t \in \mathcal{I}$ then $u \in \mathcal{I}$;
2. $\mathcal{I}$ covers s: if $\bigcup \mathcal{I} = s$.

Intuitively, an issue is identified with the set of pieces of information that settle it. Examples of issues over $\{11, 10, 01\}$:



Propositions

- On a given state of the common ground, a proposition can provide information by specifying an enhancement $t \subseteq s$.
- It can request information by specifying an issue $\mathcal{I}$ over s.
- In general, we think of a proposition as having both effects:
  - it provides information by specifying an enhancement $t \subseteq s$;
  - it requests information by specifying an issue $\mathcal{I}$ over the new common ground t.



Propositions

Definition (Propositions)

A proposition on s is a pair $A = (t, \mathcal{I})$, where:

- t is an enhancement of s called the informative content of A
- $\mathcal{I}$ is an issue over t called the inquisitive content of A

But since $\mathcal{I}$ must be an issue over t, the informative content t is determined by the inquisitive content $\mathcal{I}$: $t = \bigcup \mathcal{I}$. So we can identify the proposition with the inquisitive component $\mathcal{I}$:

Definition (Propositions, simplified)

A proposition on s is a downward closed set of enhancements of s. The set of propositions on s is denoted Π_s.

Propositions

The informative content of a proposition is retrieved as the union.

Definition (Informative content)

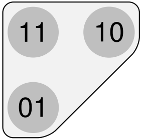
$$\text{info}(\mathcal{I}) = \bigcup \mathcal{I}$$

Definition (Informativeness, inquisitiveness)

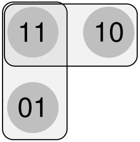
Let $\mathcal{I}$ be a proposition on s:

- $\mathcal{I}$ is informative in s in case $\text{info}(\mathcal{I}) \subset s$;
- $\mathcal{I}$ is inquisitive in s in case $\text{info}(\mathcal{I}) \notin \mathcal{I}$.

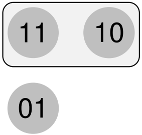
Propositions



Non-informative
Non-inquisitive



Non-informative
Inquisitive



Informative
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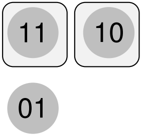


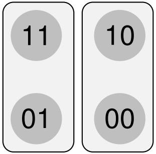
Informative
Inquisitive

Meanings

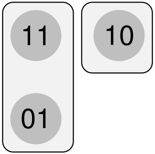
- A meaning should be a function M which associates to each state s a proposition $M(s) \in \Pi_s$ expressed on s.
- However, not *any* function will do: the propositions expressed in different states should be related in a coherent way.

Definition (Compatibility condition)

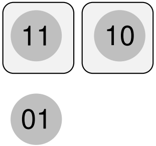
A function M which takes any state s to a proposition $M(s) \in \Pi_s$ is compatible in case whenever $t \subseteq s$, $M(t) = M(s) \cap \wp(t)$.



$A \in \Pi_\omega$



$B \in \Pi_{\{11,10,01\}}$
Coherent with A



$C \in \Pi_{\{11,10,01\}}$
Incoherent with A

Meanings

Definition (Meanings)

A meaning is a compatible function.

Definition (Informative and inquisitive meanings)

A meaning M is:

- informative if the proposition $M(s)$ is informative for some s;
- inquisitive if the proposition $M(s)$ is inquisitive for some s.

Meanings

Since meanings are obtained by restriction, their action is determined by the proposition expressed on ω.

Fact

Meanings one-to-one correspond with propositions on ω:

- A meaning M is uniquely determined by the proposition $M(\omega)$ expressed on ω. For, by compatibility: $M(s) = M(\omega) \cap \wp(s)$.
- Viceversa, any proposition A on ω determines a meaning, namely $M_A(s) = A \cap \wp(s)$.

Fact

A meaning M is informative (inquisitive) iff the proposition $M(\omega)$ is.

Semantics

Definition (Language)

We consider a propositional language built from:

- set $\mathcal{P}$ of propositional letters
- connectives $\bot, \wedge, \vee, \rightarrow$

Definition (Abbreviations)

- negation: $\neg\varphi$ for $\varphi \rightarrow \bot$
- assertive closure: $!\varphi$ for $\neg\neg\varphi$
- open question operator: $?_o\varphi$ for $\varphi \vee \neg\varphi$

We need to provide each formula φ with a meaning.
We will do so by associating to each φ a proposition $[\varphi]$ over ω.

Semantics

Definition (Truth-set)

The truth-set $|\varphi|$ of a formula φ is simply the set of worlds where φ is classically true.

Definition (Semantics)

- $[p] = \wp(|p|)$
- $[\bot] = \{\emptyset\}$
- $[\varphi \wedge \psi] = [\varphi] \cap [\psi]$
- $[\varphi \vee \psi] = [\varphi] \cup [\psi]$
- $[\varphi \rightarrow \psi] = [\varphi] \Rightarrow [\psi]$

Where $A \Rightarrow B = \{s \mid \text{ for all } t \subseteq s, \text{ if } t \in A \text{ then } t \in B\}$

Semantics

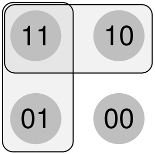
Recall that the informative content of $[\varphi]$ is $\text{info}[\varphi] = \bigcup[\varphi]$

Fact (Informative content is treated classically)

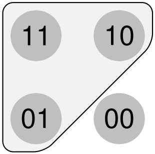
For any φ, *info*$[\varphi] = |\varphi|$.

So, inquisitive semantics:

- preserves the classical treatment of information;
- adds a second dimension of meaning: inquisitiveness.

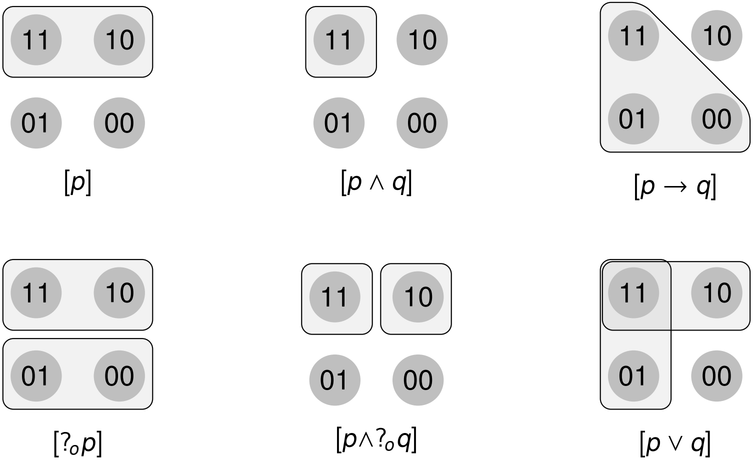


$[p \vee q]$



$|p \vee q|$

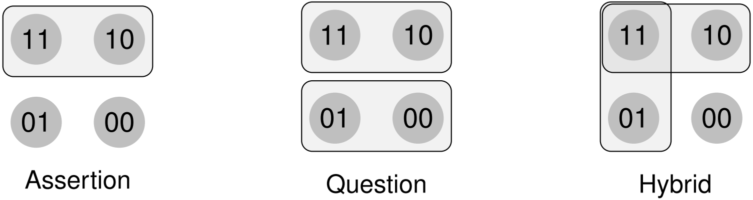
Semantics


11 10 01 00
$[p]$
11 10 01 00
$[p \wedge q]$
11 10 01 00
$[p \rightarrow q]$
11 10 01 00
$[?_o p]$
11 10 01 00
$[p \wedge ?_o q]$
11 10 01 00
$[p \vee q]$

Semantics

Definition (Questions, assertions, hybrids)

- φ is a question if $[\varphi]$ is non-informative.
- φ is an assertion if $[\varphi]$ is non-inquisitive.
- φ is hybrid if it is both informative and inquisitive.



Assertions

Assertions are formulas whose unique effect on a context, if any, is to provide information.

Fact (Sufficient conditions for assertionhood)

- p, $\bot$ are assertions
- if φ and ψ are assertions, so is $\varphi \wedge \psi$
- if ψ is an assertion, so is $\varphi \rightarrow \psi$

Corollary (Disjunction is the only source of inquisitiveness)

Any disjunction-free formula is an assertion.

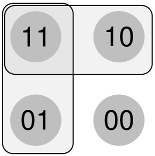
Corollary (Negations are assertions)

$\neg\varphi$ is always an assertion.

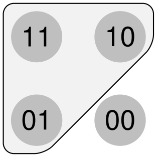
Assertions

Fact

- $!\varphi$ *is always an assertion*
- $|!\varphi| = |\varphi|$
- φ *is an assertion* $\iff$ $\varphi \equiv !\varphi$



$[p \vee q]$



$[!(p \vee q)]$

Questions

Goal

Since inquisitive semantics was designed to incorporate inquisitive content into meaning, an important goal is to obtain an accurate representation of different kinds of questions.

- Questions are formulas whose only effect on a context, if any, is to request formation.
- φ is a question iff $[\varphi]$ is non-informative, i.e. iff $\text{info}[\varphi] = \omega$.
- But we have seen that $\text{info}[\varphi] = |\varphi|$.
- So, φ is a question iff it is a classical tautology.

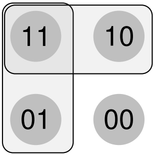
Questions

Recall that $?_o\varphi$ is defined as $\varphi \vee \neg\varphi$, a tautology.

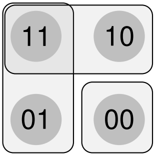
Fact (Open question operator and division)

- $?_o\varphi$ is always a question
- φ is a question $\iff$ $\varphi \equiv ?_o\varphi$
- Division $\varphi \equiv\ !\varphi \wedge ?_o\varphi$

$?_o$ is call open since it makes φ into a question by adding to the possibilities for φ the possibility for the rejection of φ.



$[p \vee q]$



$[?(p \vee q)]$

Questions

1. Polar question $?p$

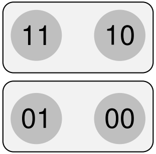
   Will John go to London?

2. Conjunctive question $?p \wedge ?q$

   Will John go to London? And, will Bill go to Paris?

3. Conditional question $p \rightarrow ?q$

   If John goes to London, will Bill go as well?



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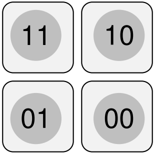
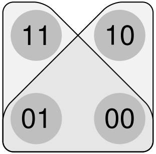


2. $[?p \wedge ?q]$



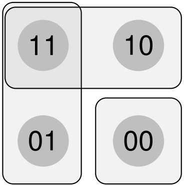
3. $[p \rightarrow ?q]$

Questions

Alternative question

(1) Will John go to London, or will he go to Paris?

- In inquisitive semantics, (1) is usually interpreted as $?(p \vee q)$



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Alternative question

(1) Will John go to London, or will he go to Paris?

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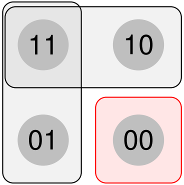
- However, the response $\neg(p \vee q)$ does not seem to be invited by (1).



$[?(p \vee q)]$

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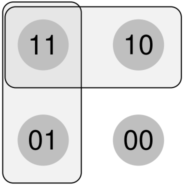
- It would be more accurate to model (1) as requesting to establish either p or q.



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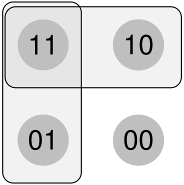

$[p \vee q]$

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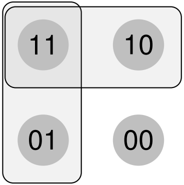
- However, the response $\neg(p \vee q)$ does not seem to be invited by (1).
- It would be more accurate to model (1) as requesting to establish either p or q.
- This proposition is expressed by $p \vee q$.
- But unlike (1), $p \vee q$ is not a question: it provides the information that one of p and q holds.



$[p \vee q]$

Presuppositions

Alternative question

(1) Will John go to London, or will he go to Paris?

- The information $p \vee q$ does not seem to be provided by (1).
- Rather, it seems to be presupposed by (1).
- But what does this mean exactly?

Presuppositions

- In line with much literature on presuppositions in dynamic semantics, we regard presuppositions as domain restrictions.
- A sentence with a presupposition is specialized to operate on contexts of a certain type.

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John quit smoking

operates on contexts where it is established that John used to smoke providing the information that he no longer smokes.

Presuppositions

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- For instance, a sentence like:

  John quit smoking

  operates on contexts where it is established that John used to smoke providing the information that he no longer smokes.
- We focus on such factive presuppositions, i.e. presuppositions which require a certain piece of information to be established.

Presuppositions

Goal

Devise a notion of meaning which incorporates a notion of presupposition.

- We will keep the same notion of proposition.
- We will model a presupposition as an information state, consisting of the worlds verifying the presupposition.

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- We defined a meaning M as compatible functions which determines, for any context s, a proposition $M(s)$ on s.

Presuppositions

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Devise a notion of meaning which incorporates a notion of presupposition.

- We will keep the same notion of proposition.
- We will model a presupposition as an information state, consisting of the worlds verifying the presupposition.
- We defined a meaning M as compatible functions which determines, for any context s, a proposition $M(s)$ on s.
- To deal with presuppositions, it is natural to relax the totality requirement and allow for partial meanings.
- We will let a meaning M to be a compatible function which express a proposition $M(s)$ on some contexts.

Presuppositions

Definition (Meanings with presuppositions)

Let π be a state. A meaning with presupposition π is a compatible function M mapping each state $s \subseteq \pi$ to a proposition $M(s) \in \Pi_s$.

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Let π be a state. A meaning with presupposition π is a compatible function M mapping each state $s \subseteq \pi$ to a proposition $M(s) \in \Pi_s$.

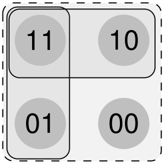
- Before, meanings were determined by propositions over ω.
- Now, the compatibility condition ensures that meanings are determined by a presupposition π and a proposition over π.

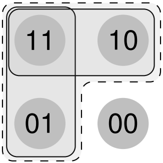
Fact

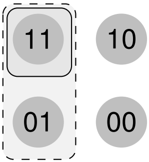
- A meaning M with presupposition π is fully determined by the proposition $M(\pi)$ expressed over π.
- Viceversa, any proposition A over a state π determines a meaning M_A with presupposition π.

Semantics with presuppositions

Examples







Goal

To associate meanings to formulas, we specify for each φ:

- a presupposition $\pi(\varphi)$ and
- a proposition $[\varphi]$ over $\pi(\varphi)$

Question

How do presupposition interact with the propositional connectives?

Conjunction

1. John quit smoking. ψ
2. John used to smoke, but he quit. $\varphi \wedge \psi$

In (2), the presupposition is canceled. Why?

Conjunction

1. John quit smoking. ψ
2. John used to smoke, but he quit. $\varphi \wedge \psi$

In (2), the presupposition is canceled. Why?

- When ψ is evaluated, the information it presupposes is available, since it has just been supplied by φ.
- Thus, for a conjunction $\varphi \wedge \psi$ to operate successfully on s:
  1. φ must be defined on s
  2. ψ must be defined on $s \cap |\varphi|$
- Thus, writing $s \Rightarrow t$ for $\overline{s} \cup r$, the presupposition is:
  $\pi(\varphi \wedge \psi) = \pi(\varphi) \cap \{s \mid s \cap |\varphi| \subseteq \pi(\psi)\} = \pi(\varphi) \cap (|\varphi| \Rightarrow \pi(\psi))$

Implication

Similarly, the presupposition is canceled in (3).

3. If John used to smoke, he quit. $\varphi \rightarrow \psi$

- When evaluating the consequent, the information provided by the antecedent may be assumed.
- Thus, just like for conjunction, for $\varphi \rightarrow \psi$ to be defined on s:
  1. φ must be defined on s
  2. ψ must be defined on $s \cap |\varphi|$
- And the presupposition is $\pi(\varphi \rightarrow \psi) = \pi(\varphi) \cap (|\varphi| \Rightarrow \pi(\psi))$.
- In the example, $\pi(\varphi) = \omega$ and $\pi(\psi) = |\varphi|$, so we get: $\pi(\varphi \wedge \psi) = \pi(\varphi \rightarrow \psi) = \omega \cap (|\varphi| \Rightarrow |\varphi|) = \omega \cap \omega = \omega$

Disjunction

This case is more tricky. No recipe seems to cover all examples in a satisfactory way. We will give one reasonable definition that fits our purposes.

4. John is still in Paris, or he is still in London. $\varphi \vee \psi$

- (4) is well-defined in case we know that John was either in Paris or in London.
- So, we take the presupposition of a disjunction to be the disjunction of the presuppositions.

$$\pi(\varphi \vee \psi) = \pi(\varphi) \cup \pi(\psi)$$

Semantics with presuppositions

Definition (Semantics)

φ	$\pi(\varphi)$	$[\varphi]$
p	ω	$\wp(\lvert p\rvert)$
$\bot$	ω	$\{\emptyset\}$
$\psi \wedge \chi$	$\pi(\psi) \cap (\lvert\psi\rvert \Rightarrow \pi(\chi))$	$[\psi] \cap [\chi]$
$\psi \vee \chi$	$\pi(\psi) \cup \pi(\chi)$	$[\psi] \cup [\chi]$
$\psi \to \chi$	$\pi(\psi) \cap (\lvert\psi\rvert \Rightarrow \pi(\chi))$	$[\psi] \Rightarrow [\chi]$

Notice that $[\varphi]$ is defined just as before for any φ.

Semantics with presuppositions

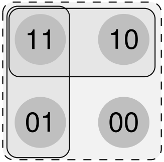
- However, in this system no formula is presuppositional.
- To introduce presuppositions, we add to the language a presupposition operator.
- If φ and ψ are formulas, $\langle\varphi\rangle\psi$ is a formula.
- The effect of $\langle\varphi\rangle$ is to add the presupposition φ.
- That is, $\langle\varphi\rangle\psi$ restricts the meaning of ψ to $|\varphi| = \bigcup[\varphi]$.

Semantics with presuppositions

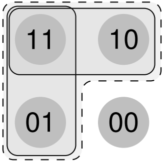
Definition (Presupposition operator)

- $\pi(\langle\varphi\rangle\psi) = \pi(\psi) \cap |\varphi|$
- $[\langle\varphi\rangle\psi] = [\psi] \cap \wp(|\varphi|)$

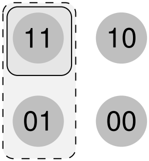
Examples



$p \vee q$



$\langle p \vee q\rangle(p \vee q)$



$\langle q\rangle p$

Semantics with presuppositions

Definition (Informativeness, inquisitiveness)

φ is said to be:

informative if in some state it expresses an informative proposition;

inquisitive if in some state it expresses an inquisitive proposition.

Fact

φ is informative iff $|\varphi| \subset \pi(\varphi)$

φ is inquisitive iff $|\varphi| \notin [\varphi]$

Semantics with presuppositions

Definition (Questions, assertions, hybrid)

φ is an assertion if it is non-inquisitive.

φ is a question if is non-informative.

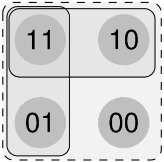
φ is a hybrid if it is both informative and inquisitive.

Definition (Presuppositionalilty)

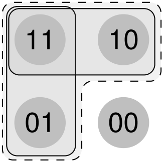
φ is said to be presuppositional in case $\pi(\varphi) \neq \omega$.

Semantics with presuppositions

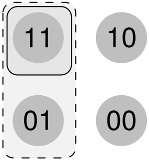
Examples



$p \vee q$
Non-presuppositional hybrid



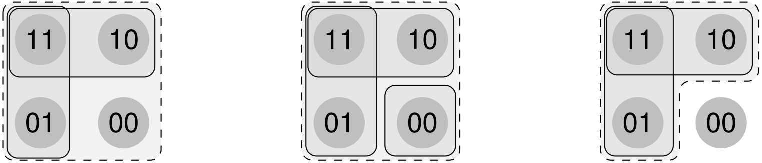
$\langle p \vee q \rangle (p \vee q)$
Presuppositional question



p
Presuppositional assertion

Semantics with presuppositions

- φ is a question when $[\varphi]$ covers the presupposition $\pi(\varphi)$.
- There are two natural recipes to turn a φ into a question:
  1. We can extend the meaning to allow for rejection of φ.
     This is the effect of the open question operator $?_o\varphi := \varphi \vee \neg\varphi$.
  2. We can add the presupposition that one of the proposed possibilities holds. We define a closed question operator with this effect: $?_c\varphi = \langle\varphi\rangle\varphi$.



$p \vee q$ $\quad$ $?_o(p \vee q)$ $\quad$ $?_c(p \vee q)$

Semantics with presuppositions

Fact (Both $?_c$ and $?_o$ are question operators)

- For any φ, $?_c\varphi$ and $?_o\varphi$ are questions
- φ is a question $\iff \varphi \equiv ?_o\varphi \iff \varphi \equiv ?_c\varphi$

Alternative questions

The formula $?_c(p_1 \vee \cdots \vee p_n)$:

- is a question, i.e. non-informative;
- presupposes $p_1 \vee \cdots \vee p_n$;
- requests a response which establishes one of the p_i.

So, $?_c$ gives us the means for a proper representation of (closed) alternative questions.

The semantics at work

The *still* or *again* puzzle

1. John is in Paris. p
2. John is still in Paris.
3. John is in Paris again.
4. John is still in Paris, or he is in Paris again.
5. Is John still in Paris, or is he in Paris again?

For lack of a better phrasing, we will write the presuppositions of (2) and (3) as:

- $s =$ John was continuously in Paris before.
- $a =$ John was discontinuously in Paris before.

The semantics at work

1. John is in Paris.
4. John is still in Paris, or he is in Paris again.
5. Is John still in Paris, or is he in Paris again?

- In (4), $s \vee a$ (still or again) seems to be the presupposition, while (1) seems to be the information provided (*at-issue*).
- However, while appearing only as presuppositions, *s* and *a* also seem to contribute to the proposition, raising an issue.
- Moreover, when (4) is turned into an alternative question, this issue is the only 'at issue' content, while information provided by (1) is now part of what is presupposed!
- How is this possible?

The semantics at work

1. John is in Paris. p
2. John is still in Paris. $\langle s \rangle p$
3. John is in Paris again. $\langle a \rangle p$
4. John is still in Paris, or he is in Paris again. $\langle s \rangle p \vee \langle a \rangle p$
5. Is John still in Paris, or is he in Paris again? $?_c(\langle s \rangle p \vee \langle a \rangle p)$

Computing the meanings

- $\pi(\langle s \rangle p) = \pi(p) \cap |s| = |s|$
- $[\langle s \rangle p] = [p] \cap \wp(|s|) = \wp(p) \cap \wp(s) = \wp(|p \cap s|)$
- $\langle s \rangle p$ is an assertion that presupposes s and provides the information p
- Analogously for $\langle a \rangle p$

The semantics at work

4. John is still in Paris, or he is in Paris again.

- $\pi(\langle s\rangle p \vee \langle a\rangle p) = \pi(\langle s\rangle p) \cup \pi(\langle a\rangle p) = |s| \cup |a| = |s \vee a|$
- $[\langle s\rangle p \vee \langle a\rangle p] = [\langle s\rangle p] \cup [\langle a\rangle p] = \wp(|p \wedge s|) \cup \wp(|p \wedge a|)$
- $|\langle s\rangle p \vee \langle a\rangle| = \bigcup[\langle s\rangle p \vee \langle a\rangle] = |p \cap s| \cup |p \cap a| = |p| \cap |s \vee a|$

So, our analysis predicts that (4):

1. presupposes that John was in Paris before (either continuously or otherwise);
2. is informative, providing the information that John is in Paris;
3. is also inquisitive, requesting a response which establishes whether John is still or again in Paris.

The semantics at work

5. Is John *still* in Paris, or is he in Paris *again*?

- $\pi(?_c(\langle s\rangle p \vee \langle a\rangle p)) = \cdots = |p \wedge (s \vee a)|$
- $[?_c(\langle s\rangle p \vee \langle a\rangle p)] = [\langle s\rangle p \vee \langle a\rangle p] = \wp(|s \wedge p|) \cup \wp(|a \wedge p|)$
- $|?_c(\langle s\rangle p \vee \langle a\rangle p)| = |\langle s\rangle p \vee \langle a\rangle| = |p \wedge (s \vee a)|$

So, our analysis predicts that (5):

1. presupposes two things:
   - that John is in Paris
   - that John was in Paris before (continuously or not)
2. is a question, since it provides no new information;
3. is inquisitive, requesting a response which establishes whether John is still or again in Paris.

Conclusions

- Inquisitive semantics aims at providing the tools to model information exchange through conversation.
- In particular, we want to represent the meaning of questions.
- A theory of meanings involving presuppositions is needed for a satisfactory modeling of alternative questions.
- In line with the tradition of dynamic semantics, we regard presuppositions as domain restriction on meanings.
- We proposed a system for a propositional language and showed that it can deal with cases involving twisted interplay between presuppositions and at-issue content.

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- We proposed a system for a propositional language and showed that it can deal with cases involving twisted interplay between presuppositions and at-issue content.
- Thanks for your attention!