

Computing Compliance

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`www.illc.uva.nl/inquisitive-semantics`

Umass Amherst, February 1, 2010

Sources

- **Computing compliance**
Ivano Ciardelli, Irma Cornelisse, Jeroen Groenendijk, and Floris Roelofsen. Workshop on Logic of Rational Interaction, Chongqing, China, October 2009.
- **Irma Cornelisse's BSc thesis**
defended June 2009 at the University of Amsterdam.
- **Inquisitive logic**
Ivano Ciardelli and Floris Roelofsen.
To appear in the Journal of Philosophical Logic.
- Accompanying website:
[http://www.illc.uva.nl/inquisitive-semantics/
computing-compliance/](http://www.illc.uva.nl/inquisitive-semantics/computing-compliance/)

Compliance

The logical notion of **compliance** judges whether a sentence makes a contribution towards resolving a given issue.

Just as...

The logical notion of **entailment** judges whether a sentence follows from a given set of premises.

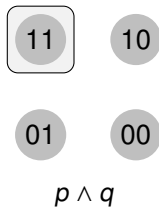
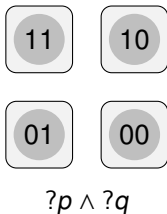
Why bother?

- In many practical applications, it is important to know what the appropriate responses to a given question are. Think of **question-answer systems** or **dialogue systems**;
- People generally assume each other to say things that are compliant with the issues at hand. This common assumption gives rise to **pragmatic enrichment** of the literal content of what is said.

Three Ways of Being Compliant

1. **completely resolve** the given issue;
2. **partially resolve** the given issue;
3. **replace** the given issue by an easier to answer sub-issue.

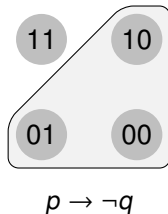
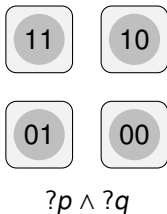
Example, complete resolution:



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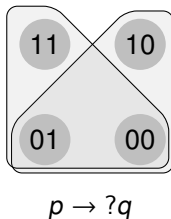
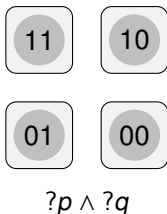
Example, partial resolution:



Three Ways of Being Compliant

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Example, replace by an easier to answer sub-issue:

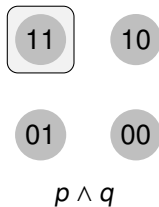
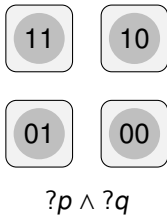


Formal Characterization

φ is **compliant** with ψ iff:

1. every possibility in $[\varphi]$ is the **union** of some possibilities in $[\psi]$;
2. every possibility in $[\psi]$ restricted to $|\varphi|$ is contained in a possibility in $[\varphi]$.

Example, complete resolution:

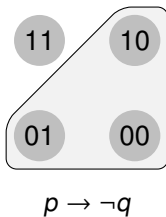
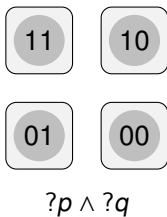


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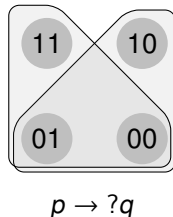
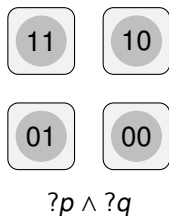


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Example, replace by an easier to answer sub-issue:

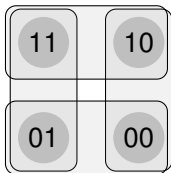


The Restriction Clause

Every possibility in $[\psi]$ **restricted** to $|\varphi|$ must be contained in a possibility in $[\varphi]$.

\Rightarrow possibilities in $[\psi]$ may only be eliminated by providing information.

Example, violation of the restriction clause:



$?p \vee ?q$



$?p$

Computing Compliance

Task

For a given formula ψ , compute all compliant responses to ψ .

Crucial Step

Compute a **disjunctive normal form** $\text{DNF}(\psi)$, such that:

- $\text{DNF}(\psi) \equiv \psi$
- $\text{DNF}(\psi) = \psi_1 \vee \psi_2 \vee \dots \vee \psi_n$

where each ψ_i uniquely corresponds with a possibility for ψ

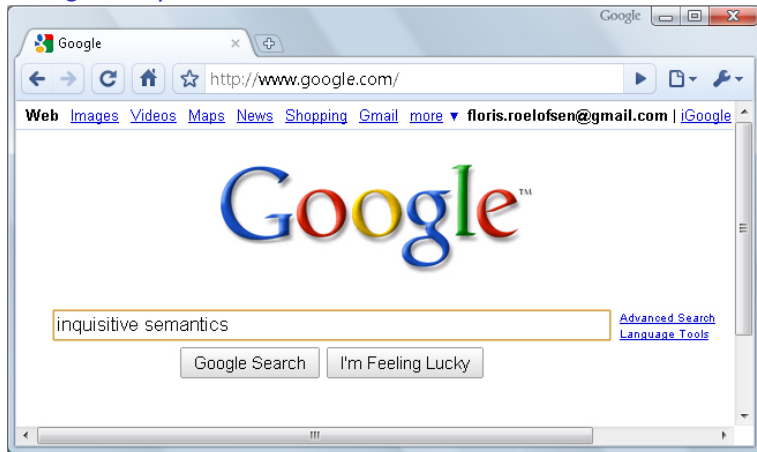
Computing Compliance

Then...

- Each formula of the form $!(\psi_{i_1} \vee \dots \vee \psi_{i_k})$ is a compliant response;
- Each disjunction of such formulas is a potentially compliant response;
- Filter out all potentially compliant responses that violate the restriction clause;
- and you're done.

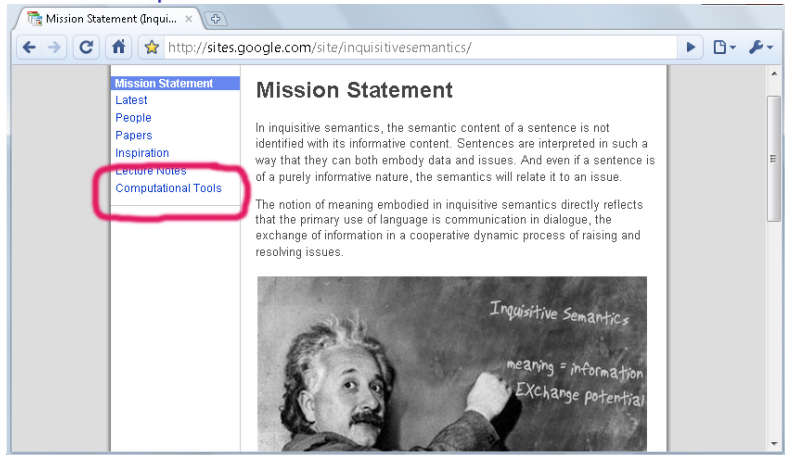
Demo

Google: inquisitive semantics



Demo

Go to: computational tools



The screenshot shows a web browser window with the address bar displaying `http://sites.google.com/site/inquisitivesemantics/`. The page title is "Mission Statement (Inqui...". The left sidebar contains a menu with the following items: "Mission Statement", "Latest", "People", "Papers", "Inspiration", "Lecture Notes", and "Computational Tools". The "Computational Tools" item is highlighted with a red rectangular box. The main content area is titled "Mission Statement" and contains two paragraphs of text. The first paragraph states: "In inquisitive semantics, the semantic content of a sentence is not identified with its informative content. Sentences are interpreted in such a way that they can both embody data and issues. And even if a sentence is of a purely informative nature, the semantics will relate it to an issue." The second paragraph states: "The notion of meaning embodied in inquisitive semantics directly reflects that the primary use of language is communication in dialogue, the exchange of information in a cooperative dynamic process of raising and resolving issues." Below the text is a black and white photograph of Albert Einstein pointing at a chalkboard. The chalkboard has the text "Inquisitive Semantics" at the top, "meaning = information" in the middle, and "Exchange potential" at the bottom.

Mission Statement (Inqui... x

http://sites.google.com/site/inquisitivesemantics/

Mission Statement

Latest

People

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Inspiration

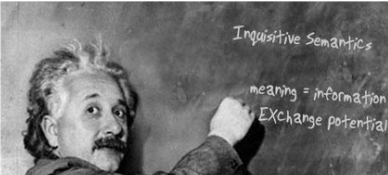
Lecture Notes

Computational Tools

Mission Statement

In inquisitive semantics, the semantic content of a sentence is not identified with its informative content. Sentences are interpreted in such a way that they can both embody data and issues. And even if a sentence is of a purely informative nature, the semantics will relate it to an issue.

The notion of meaning embodied in inquisitive semantics directly reflects that the primary use of language is communication in dialogue, the exchange of information in a cooperative dynamic process of raising and resolving issues.



Demo

Go to: compute compliance

Computational Tools (In... x) Computing Compliance x

http://www.illc.uva.nl/inquisitive-semantics/computing-compliance/

Computational Tools for Inquisitive Semantics

- Home
- Compute
- Possibilities
- Disjunctive NPs
- Compliance
- About

Inquisitive Semantics

Inquisitive semantics is a new approach to natural language semantics. Traditional approaches focus exclusively on informative content. Inquisitive semantics aims to capture both informative and inquisitive content in a uniform way. [More...](#)

Possibilities

In inquisitive semantics, each sentence is taken to express a *proposal* to enhance the common ground of a conversation. Such a proposal consists of one or more *possibilities*. Each possibility embodies a possible way to enhance the common ground.

Demo

Enter a formula and hit 'compute compliant responses'

The screenshot shows a web browser window with the address bar displaying `http://www.illc.uva.nl/inquisitive-semantic/computing-compliance/`. The page has a yellow background and a red header bar with the title "Computational Tools for Inquisitive Semantics". On the left, there is a sidebar with four buttons: "Home", "Compute", "About", and a list of links: "Possibilities", "Disjunctive NFs", and "Compliance". The main content area contains the text: "For more background information, see the inquisitive semantics [website](#) or a short [paper](#)." Below this text is a set of logical symbols in buttons: \neg , \wedge , \vee , \rightarrow , p , q , $($, $)$, \mathcal{C} , and \mathcal{CE} . Below these buttons, the formula $p \vee q$ is entered into a text field. A red hand-drawn rectangle highlights the text field containing $p \vee q$ and the button labeled "Compute Compliant Responses" located directly below it.

Demo

Lo and behold

The screenshot shows a web browser window with the title 'Computational Tools for Inquisitive Semantics'. The address bar shows the URL <http://www.illc.uva.nl/inquisitive-semantics/computing-compliance/>. The page has a yellow background and a red header bar with the title.

On the left side, there are three yellow buttons: 'Home', 'Compute', and 'About'. Below the 'Compute' button, there is a list of links: [Possibilities](#), [Disjunctive NFs](#), and [Compliance](#).

In the center, there is a keyboard interface with buttons for logical symbols: \neg , \wedge , \vee , \rightarrow , p , q , $($, $)$, \mathcal{C} , and \mathcal{CE} . Below these buttons is a button labeled 'Compute Compliant Responses'.

At the bottom, there are four diagrams labeled IMAGE0, IMAGE1, IMAGE2, and IMAGE3. Each diagram shows a 2x2 grid of circles containing binary strings. IMAGE0 has a diagonal line from the top-left to the bottom-right. IMAGE1, IMAGE2, and IMAGE3 show the same 2x2 grid without the diagonal line.

IMAGE0	IMAGE1	IMAGE2	IMAGE3
11	11	11	11
10	10	10	10
01	01	01	01
00	00	00	00

Possible extension

Computing preferred compliant responses

- There are often good reasons to **prefer** certain compliant responses over others (Groenendijk and Roelofsen, 2009);
- Develop an algorithm that, given an initiative ψ and an agent A with information state σ_A , determines the **most compliant** response(s) to ψ that A may truthfully utter.