

Computing Compliance

Floris Roelofsen

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/>

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.

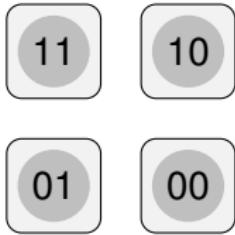
Why bother?

- 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.

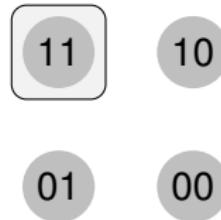
Three Ways of Being Compliant

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:



? $p \wedge ?q$

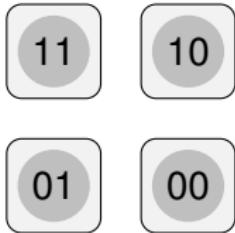


$p \wedge q$

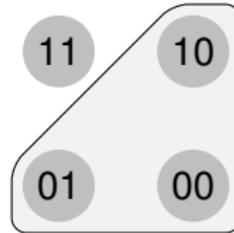
Three Ways of Being Compliant

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, partial resolution:



? $p \wedge ?q$

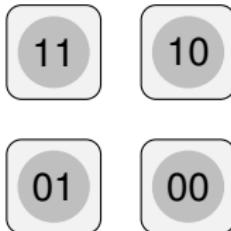


$p \rightarrow \neg q$

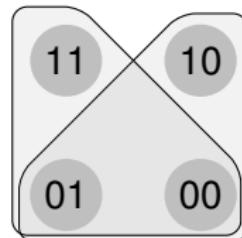
Three Ways of Being Compliant

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, replace by an easier to answer sub-issue:



$?p \wedge ?q$



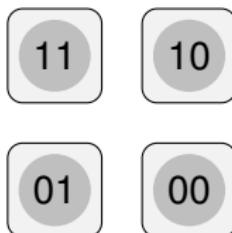
$p \rightarrow ?q$

Formal Characterization

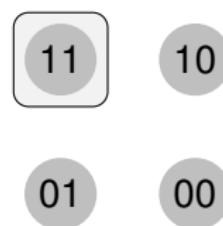
φ is compliant with ψ iff:

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:



? $p \wedge ?q$



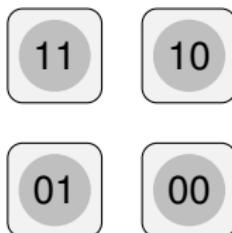
$p \wedge q$

Formal Characterization

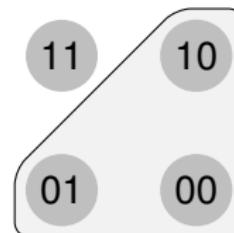
φ is compliant with ψ iff:

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, partial resolution:



? $p \wedge ?q$



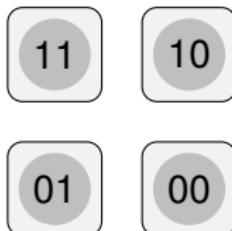
$p \rightarrow \neg q$

Formal Characterization

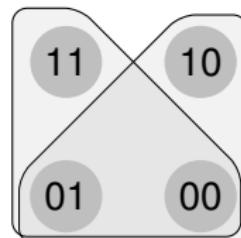
φ is compliant with ψ iff:

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, replace by an easier to answer sub-issue:



?p \wedge ?q



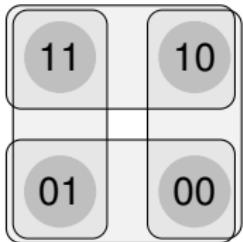
p \rightarrow ?q

The Restriction Clause

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

⇒ 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

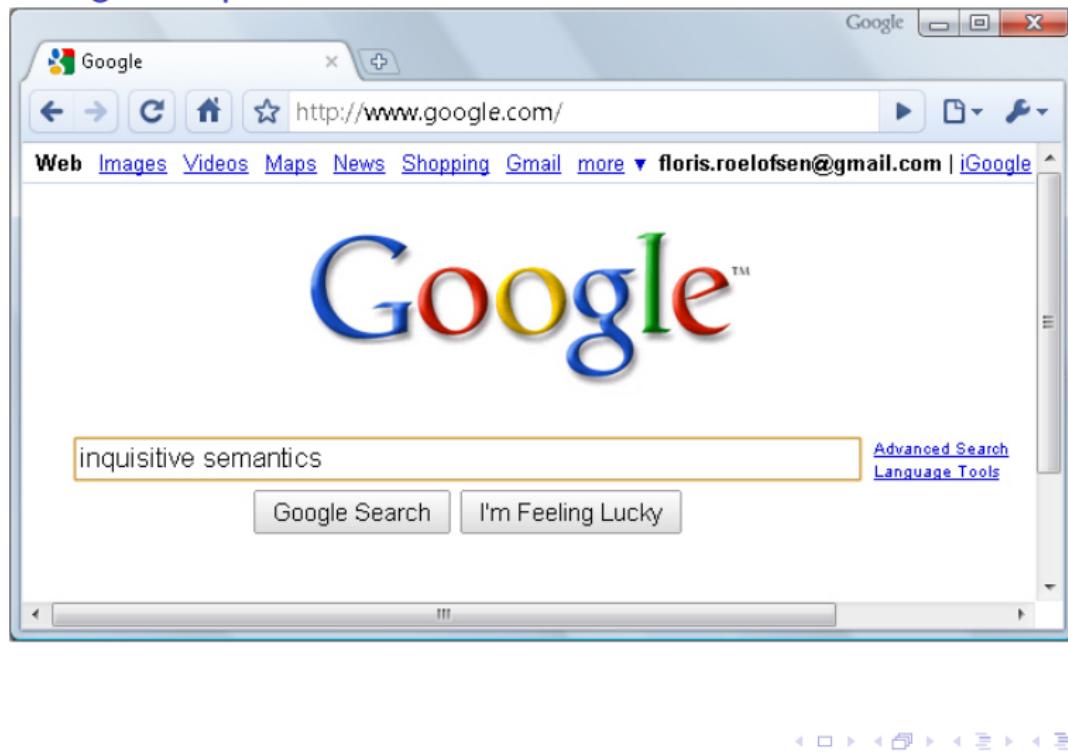
Computing Compliance

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

Mission Statement (Inqui... x +)

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

Mission Statement

Latest
People
Papers
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 for Inquisitive Semantics

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 title "Computational Tools (In...)" and the tab "Computing Compliance". The URL is <http://www.illc.uva.nl/inquisitive-semantics/computing-compliance/>. The main content area has a red header bar with the text "Computational Tools for Inquisitive Semantics". On the left, there is a sidebar with three buttons: "Home" (yellow), "Compute" (red, currently selected), and "About" (yellow). Below these are three links: "- Possibilities", "- Disjunctive NFs", and "- Compliance". The main workspace contains a text input field with the formula $p \vee q$ and a button labeled "Compute Compliant Responses". A red oval highlights the formula input field and the response button. To the right of the formula input field, there is a note: "For more background information, see the inquisitive semantics [website](#) or a short [paper](#)." Above the formula input field, there is a row of logical operators: \neg , \wedge , \vee , \rightarrow , \perp , \top , $($, $)$, C , and CE .

Demo

Lo and behold

Computational Tools (In...)

Computing Compliance

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

Computational Tools for Inquisitive Semantics

Home

Compute

- Possibilities

- Disjunctive NFs

- Compliance

About

Compute Compliant Responses

IMAGE0

IMAGE1

IMAGE2

IMAGE3

11 10
01 00

11 10
01 00

11
01
00

11 10
01 00

The screenshot shows a web-based interface for computational tools related to inquisitive semantics. At the top, there's a browser-like header with tabs for 'Computational Tools (In...)' and 'Computing Compliance'. Below that is a red header bar with the title 'Computational Tools for Inquisitive Semantics'. On the left, there's a sidebar with links for 'Home', 'Compute', and three menu items under a '-' symbol: 'Possibilities', 'Disjunctive NFs', and 'Compliance'. Below the sidebar is an 'About' link. In the center, there's a button labeled 'Compute Compliant Responses'. Below this are four sections labeled 'IMAGE0', 'IMAGE1', 'IMAGE2', and 'IMAGE3', each containing a 2x2 grid of circles. The first three images have diagonal lines through them. The values in the circles are as follows:

- IMAGE0:** Top-left circle contains '11', top-right '10', bottom-left '01', bottom-right '00'.
- IMAGE1:** Top-left circle contains '11', top-right '10', bottom-left '01', bottom-right '00'.
- IMAGE2:** Top-left circle contains '11', bottom-left circle contains '01', bottom-right circle contains '00'.
- IMAGE3:** Top-left circle contains '11', top-right circle contains '10', bottom-left circle contains '01', bottom-right circle contains '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.