Why study argumentation?

Why from a computational and/or linguistic perspective?

Artificial systems

Natural systems

Theoretical systems

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Realizing the dreams and countering the concerns connected to AI require the same innovation:

the development of argumentation technology
IBM’s debating technologies

1:38

https://www.youtube.com/watch?v=7g59PJxbGhY
The challenge

Develop grounded models of our complex world

The two faces of Artificial Intelligence

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Argumentation

Argumentation
is an interactive social process aimed at the balancing of different positions and interests.

Argumentation technology

Chapter 11: Argumentation and Artificial Intelligence

Argument map: Shale gas production in EU member states

Chapter 11: Argumentation and Artificial Intelligence
Mary is owner  →  John is owner

Mary is original owner  →  John is the buyer

Pros  Cons

Mary is owner  →  John is owner

Mary is original owner  →  John is the buyer

John was not bona fide

Pros  Cons

John bought the bike for €20

Main themes of Toulmin (1958)

1. Argument analysis involves half a dozen distinct elements, not just two.
2. Many, if not most, arguments are substantial, hence defeasible.
3. Standards of good reasoning and argument assessment are non-universal.
4. Logic is to be regarded as generalised jurisprudence.

Toulmin’s model

Harry was born in Bermuda ➔ So, presumably, Harry is a British subject
Since A man born in Bermuda will generally be a British subject
Unless Both his parents were aliens/ he has become a naturalized American...
On account of The following statutes and other legal provisions:

Toulmin’s model

D ➔ So, Q, C
Since W
Unless R
On account of B

Toulmin on logic

Logic as psychology
Logic as sociology
Logic as technology
Logic as mathematics
Logic as jurisprudence


Defeasible reasoning

In 1987, John Pollock published the paper 'Defeasible reasoning' in the Cognitive Science journal.

What in AI is called "non-monotonic reasoning" coincides with the philosophical notion of "defeasible reasoning".

He defines conclusive and prima facie reasons, and rebutting and undercutting defeaters.

Pollock on argument defeat

(2.2) P is a prima facie reason for S to believe Q if and only if P is a reason for S to believe Q and there is an R such that R is logically consistent with P but (P & R) is not a reason for S to believe Q.

(2.3) R is a defeater for P as a prima facie reason for Q if and only if P is a reason for S to believe Q and R is logically consistent with P but (P & R) is not a reason for S to believe Q.

Pollock’s red light example

The object is red
The object is illuminated by a red light
The object looks red

Undercutting defeat

Classes of specific reasons

(1) Deductive reasons
(2) Perception
(3) Memory
(4) Statistical syllogism
(5) Induction

Pollock 1995, Cognitive Carpentry
Dung’s basic principle of argument acceptability

The one who has the last word laughs best.

Dung’s admissible sets

Admissible, e.g.: \{\alpha, \gamma\}, \{\alpha, \gamma, \delta, \zeta, \eta\}
Not admissible, e.g.: \{\alpha, \beta\}, \{\gamma\}
Combining support and attack

Approach 1:
Dung’s abstract arguments have internal structure

Combining support and attack

Approach 2:
Arguments can attack or support

Arguing about support and attack

Toulmin’s model

Harry was born in Bermuda

Since
A man born in Bermuda will generally be a British subject

Unless
Both his parents were aliens he has become a naturalized American...

On account of

The following statutes and other legal provisions:
Datum and claim

Harry was born in Bermuda → Harry is a British subject

Datum and claim

D: Harry was born in Bermuda.
C: Harry is a British subject.
D --> C: If Harry was born in Bermuda, he is a British subject.

Datum and claim

Harry was born in Bermuda → Harry is a British subject

Datum and claim

Harry was born in Bermuda → Harry is a British subject

On arguments and Modus ponens

1. Harry was born in Bermuda. Therefore, he is a British subject.

2. Harry was born in Bermuda. If Harry was born in Bermuda, he is a British subject. Therefore, he is a British subject.

In the present setting, Modus ponens is not a representation of an argument, but specifies how evaluation values are transferred.

Warrant

Harry was born in Bermuda → Harry is a British subject

A man born in Bermuda will generally be a British subject
Remarks on nesting

1. In the diagrams, the nesting of the conditionals passes almost unnoticed.

2. Logically, nesting can be as deep as deemed appropriate.

3. "Epistemologically", there is presumably not much need for deep nesting.

Attack I (no warrants)

- Harry was born in Bermuda
- Harry is a British subject

Attack I (no warrants)

- Harry was born in Bermuda
- Harry has become a naturalized American
- Harry is a British subject

Attack I (no warrants)

- Harry was born in Bermuda
- Harry has become a naturalized American
- Harry is a British subject

Reinstatement

- Break a window
- Obligation to pay for the damages
Reinstatement

Break a window \[ \rightarrow \] Obligation to pay for the damages

Ground of justification

Save a child \[ \rightarrow \] Ground of justification

Obligation to pay for the damages

Reinstatement

Break a window \[ \rightarrow \] Obligation to pay for the damages

Save a child \[ \rightarrow \] Ground of justification

Breaking window not necessary

Don’t these call for “Attack warrants”??
If we look at the warrant-datum-claim part of Toulmin’s scheme, there are five statements that can be argued against:

- The datum D
- The claim C
- The warrant W
- The implicit conditional ‘If D, then C’ that expresses the bridge from datum to claim.
- The implicit conditional ‘If W, then if D, then C’ that expresses the bridge between warrant and the previous implicit conditional.
Attack II (with warrants)

Harry was born in Bermuda → Harry has become a naturalized American

Harry is a British subject → A man born in Bermuda will generally be a British subject

Attack I (no warrants)

Harry was born in Bermuda → Harry has become a naturalized American

Harry is a British subject

Pollock on reasons

Some reasons are **conclusive**. These are not defeasible and entail their conclusions.

Other reasons are **prima facie**. They create a presumption for their conclusion and may be defeated.

**Defeaters** are a special kind of reasons, namely reasons that defeat prima facie reasons.

One of Pollock’s puzzles

\[ R \]

\[ Q \]

\[ P \]
Pollock on argument strength and probabilities

1. Reasons can have **different strengths**, and conclusions can differ in their degree of justification.

2. Degrees of justification **do not work like probabilities**.

State of the art in formal and computational argumentation

Today’s models of argumentation have **non-standard** formal foundations.

Cf. the history of the field

Toulmin, Reiter, Pollock, Dung

Abstract argumentation semantics (1995)

- Grounded extension
- Preferred extension
- Complete extension
- Stable extension

Dung 1995

Abstract argumentation semantics (1996)

- Grounded extension
- Preferred extension
- Complete extension
- Stable extension
- Semi-stable extension
- Stage extension

Dung 1995
Verheij 1996
Argumentation semantics (2003)

Where do we stand?

Open questions about argumentation

The semantics question:
How is argumentation connected to the world of facts and data?
Today’s argumentation models do not have a transparent connection to the world of facts and data

The normative question:
When are the process of argumentation and its outcomes acceptable?
Today’s argumentation models do not provide clear acceptability criteria

Where do we stand?
What next?
How to make progress?
Further reading