Institut de Recherche
en Informatique de Toulouse

Belief Revision and Incongruity: is it a joke?

Florence Dupin de Saint-Cyr and Henri Prade

Philippe BESNARD's Festschrift
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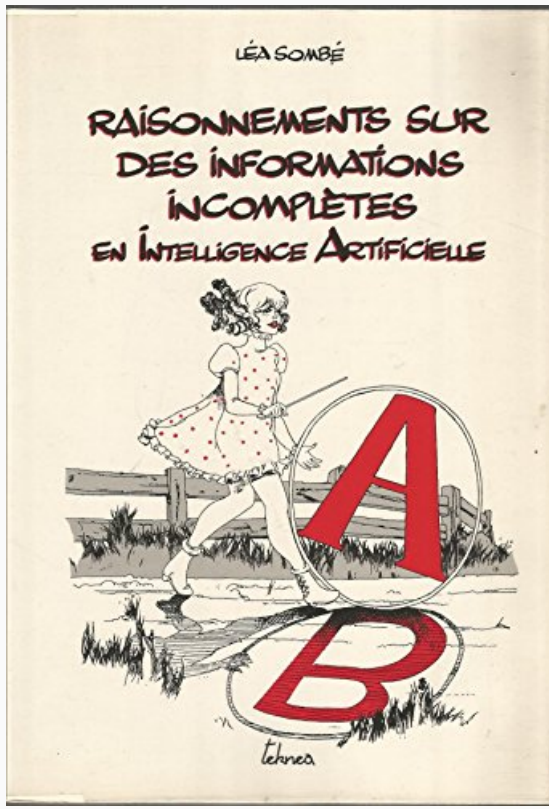
Léa Sombé alias Thea Arbee

Hello! I am Thea Arbee, the name I took, when I emigrated to America, the land, of "true AI".
My original name was Léa Sombé.
You see: "les A sont B" and "the A are B", it's all the same!

I'm a sort of godmother to a bunch of crazy young kids, who insisted on doing logical AI, at a time when it was going out of fashion, and who used my name as a pen name for two books on imperfect information handling, in different languages.

When one of my godchildren retires, I'm always happy to say hello! I am too old to come in person. I prefer to appear in the form of a pretty young avatar!

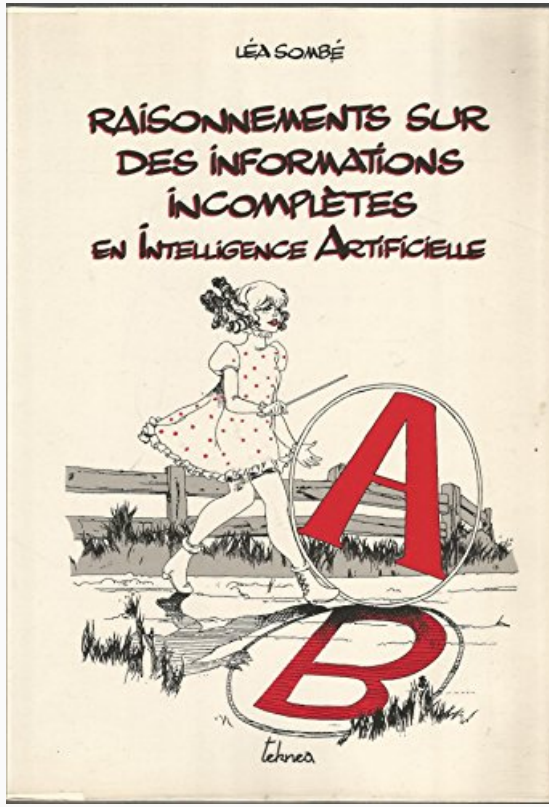


Léa Sombé alias Thea Arbee (continued)

When I was young, Philippe was a little too interested in my defaults. That's not very nice of him. He was finding a kind of logic, in those defaults! Then for a long time, he invested himself in even more dubious things, such as inconsistency!

I'm getting old, and I've got a companion. A cat whom I've named GPT. Oh, I know there's another chat GPT, based on the "Great Power of Terabytes", but in my cat's case, GPT stands, in loyalty to my godchildren Philippe, for Great Power of Theorems (sorry my cat, not Great Power of Tigers', as you would like!).

Philippe, I wish you all the best, and I leave the floor to Florence and Henry, who are trying to deal with incongruity, something certainly worse than inconsistency, and which chat GPT (not my cat, the other one), ignores completely, for sure.



Joke

Example

A man just got hit by a car. The driver gets out of the car and says, "You're lucky we're just in front of a doctor's office.
- Yes! Except the doctor is me!"

From a French collection of "funny" stories: [Nègre, 1970]

Surprising story

Definition (simple story)

simple story $=_{def}$ *pair* (α, β) *of formulas of* $\mathcal{L}$.

- Listening to a story makes an agent revise her beliefs.
- [Katsuno and Mendelzon, 1991] Revision involves a family $\preceq_K$ of pre-orders for each initial knowledge K.
- Agent characterized by $\begin{cases} \circ \text{ a belief base } K \text{ and} \\ \circ \text{ a revision mechanism } \circ \end{cases}$
- Here listener's knowledge $\Sigma = (P, \Delta)$ playing the role of both K and $\circ$:
  $\begin{cases} \circ \text{ a consistent set } P \text{ of propostional formulas: integrity constraints} \\ \circ \text{ a consistent set } \Delta \text{ of default rules } \alpha_i \rightsquigarrow \beta_i \text{: induces pre-order } \preceq_\Delta \end{cases}$
- $Mod(K \circ \varphi)$ is computed by $min(Mod(P \cup \{\varphi\}), \preceq_\Delta)$

Formalization of the joke

Definition (surprising story)

story (α, β) *surprising wrt* $(K, \circ)$ *iff*$_{def}$

$$(K \circ \alpha) \text{ consistent and } (K \circ \alpha) \cup (K \circ (\alpha \wedge \beta)) \vdash \bot$$

Example

$\alpha = injured \wedge doctorNearby$

$\beta = injured \wedge doctorHimself$

$$\Sigma = \left| \begin{array}{l} injured \wedge doctorNearby \rightsquigarrow treatedRapidly \\ injured \wedge \neg treatingDoctor \rightsquigarrow \neg treatedRapidly \\ doctorHimself \rightsquigarrow doctorNearby \\ injured \wedge doctorHimself \rightsquigarrow \neg treatingDoctor \end{array} \right.$$

$$\left. \begin{array}{ll} K \circ \alpha \models & treatedRapidly \\ K \circ (\alpha \wedge \beta) \models & \neg treatingDoctor \wedge \neg treatedRapidly \end{array} \right\} \vdash \bot$$

hence the story is surprising.

Revealing punchline

revealing punchline β: β completely admissible + β explains the situation α

Definition (revealing punchline)

the punchline β *in* (α, β) *is revealing given* $(K, \circ)$ *iff*$_{def}$

$$(K \circ \beta) \text{ consistent and } K \circ \beta \models \alpha$$

Example

$\alpha = injured \wedge doctorNearby$,
$\beta = injured \wedge doctorHimself$,

$$\Sigma = \left| \begin{array}{l} injured \wedge doctorNearby \rightsquigarrow treatedRapidly \\ injured \wedge \neg treatingDoctor \rightsquigarrow \neg treatedRapidly \\ doctorHimself \rightsquigarrow doctorNearby \\ injured \wedge doctorHimself \rightsquigarrow \neg treatingDoctor \end{array} \right.$$

$$K \circ injured \wedge doctorHimself \vdash injured \wedge doctorNearby$$

hence the punchline is revealing.

Potentially funny story

Definition (potentially funny story)

Potentially funny story = surprising with a revealing punchline.

Inspired by [Raccah, 2015] "the punchline makes us fall into an unexpected and unavoidable trap".

Proposition (never give the punchline before the end!)

If (α, β) *is a potentially funny story wrt* $(K, \circ)$
then (β, α) *is not potentially funny wrt* $(K, \circ)$.

More defs and props in the paper (The shortest jokes, Psycho-rigidity, Graduality of surprise/revealing levels, ...)

Integrating incongruity

Incongruity is related to the violation of social norms:

- lack of conformity with current practices
  - drink water from a finger bowl
  - wearing oversized shoes
- be deliberately in disregard with obvious universal knowledge
  - four elephants riddle

Example

How to put four elephants in a Citroën 2CV ?

Integrating incongruity

Incongruity is related to the violation of social norms:

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Example

How to put four elephants in a Citroën 2CV ?
Answer: two in the front and two in the rear.

Formal handling of incongruity

Definition (incongruity)

The statement (α, β) *is felt incongruous given* $\Sigma = (P, \Delta)$ *with norms* $P_N \subseteq P$ *and* $\Delta_N \subseteq \Delta$

iff_{def}

There is a norm ρ *in* P_N *or in* Δ_N *s.t.*

1. $\alpha \wedge \beta \mid\!\sim^{m}_{\Sigma \setminus \{\rho\}} \mathit{Not}\ \rho$ *(violation of* ρ*)*
2. $\beta \mid\!\sim^{m}_{\Sigma \setminus \{\rho\}} \alpha$ *(revelation in disregard of* ρ*)*

$$\text{where } \mathit{Not}\ \rho = \begin{cases} \neg\rho & \text{if } \rho \in P \\ \alpha_i \wedge \neg\beta_i & \text{if } \rho = \alpha_i \rightsquigarrow \beta_i \in \Delta \end{cases}$$

The four elephants riddle

Example

$\alpha : i \wedge e$: *4 elephants are in the 2CV car*

β: *tt* $\wedge$ *e: 2 elephants in the front and 2 in the rear of the 2CV*

$\Sigma = (P, \Delta)$ *with* $P = \{R1, R2, R3, R4\}$ *and* $\Delta = \emptyset$ *where*

R1: $h \rightarrow \neg i$ *(Something huge cannot be inside a 2CV car)*

R2: $e \rightarrow h$ *(Elephants are huge)*

R3: $h \rightarrow \neg tt$ *(Something huge cannot be put in the rear and in the front)*

R4: $tt \rightarrow i$ *(Putting in the rear and in the front implies putting inside)*

$P \cup \{\alpha\}$ is inconsistent : violation of law R2

$\{\beta\} \cup (P \setminus \{R2\}) \models \alpha$: revealing in disregard of $R2$

hence the story is felt incongruous by the listener

Conclusion

- Reasoning for understanding a joke in terms of belief revision
- Ability to reason under incomplete information is necessary
- Incongruity seen as
  - a violation of a norm
  - with the teller acting as if the norm did not exist
- Further research:
  - gradual incongruity: shocking nature of the violation
  - superiority ingredient: requires reasoning about other agents

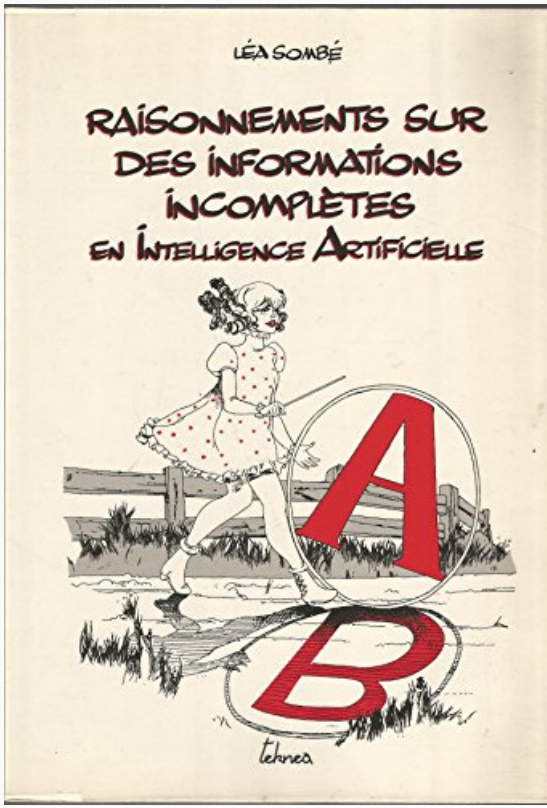
Léa Sombé alias Thea Arbee (continued again)

No, I have no question, it was perfectly clear.

Only a comment: as I said in one of my previous talks entitled: "Is the superfluous a new modality?",

Incongruity is never superfluous!

See you soon for more incongruous adventures!



- Léa Sombé's avatar was created by Elisabetta Bevacqua (Lab-STICC - COMMEDIA)
- Léa's text was written by Henri Prade
- The assignment of gestures adapted to the text were made by Florence Dupin de Saint-Cyr

Katsuno, H. and Mendelzon, A. O. (1991).
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