

Mixed-initiative scenarios for recommendations and explanations with defeasible inferences

Armand Gaudillier¹ Khaled Belahcène¹ Wassila Ouerdane¹
Sébastien Destercke²

¹Université Paris-Saclay
CentraleSupélec, Laboratoire MICS

²Sorbonne Université
Université de Technologie de Compiègne, UMR CNRS 7253 Heudiasyc

17 April 2026

Plan

1. Context and motivations
2. Possibilistic reminders
3. Explaining a recommendation
4. Dialogue game scenarios
5. Conclusion

Context and motivations

Which hotel to choose ?



DM

| Hotel | \$ | ☆ | 🚌 | 🗑️ | 🍴 |
|-----------------------|----|---|---|----|---|
| Ratz (h^1) | 7 | 4 | 8 | 4 | 4 |
| Abyss Hotel (h^2) | 4 | 7 | 4 | 6 | 6 |
| Formula Hun (h^3) | 5 | 6 | 5 | 6 | 6 |
| Overlook (h^4) | 4 | 7 | 3 | 5 | 3 |



DA

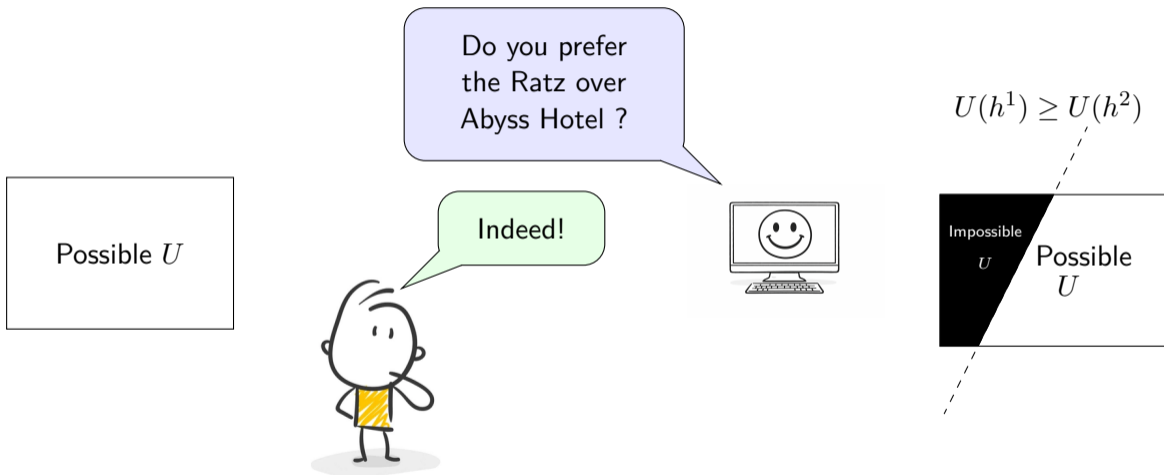
We formalise a virtual analyst that will help him build a recommendation

Additive utility model

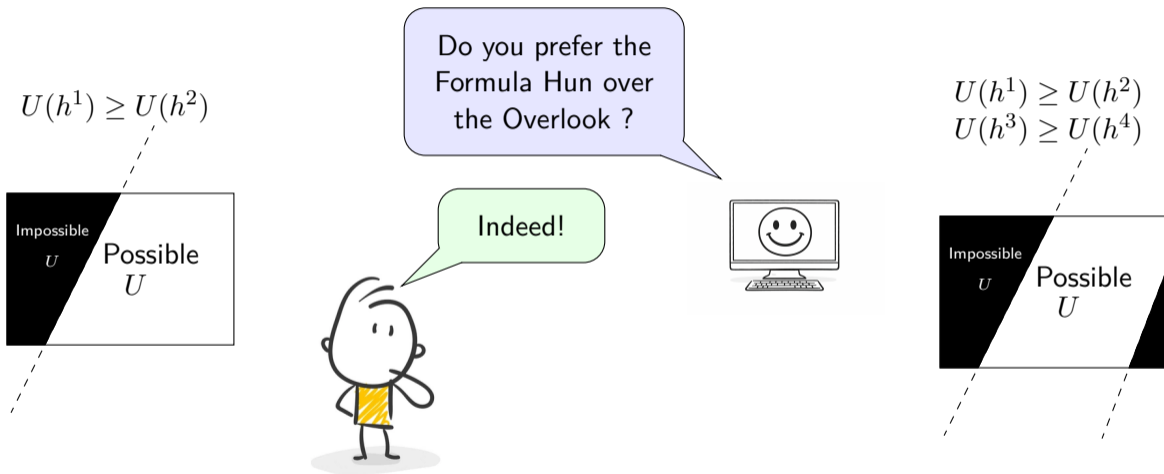
We associate with each criterion a monotonic linear value function U that represents its importance for the DM. Hence the score of a hotel h

$$U(h) = u_{\$}(h_{\$}) + u_{\star}(h_{\star}) + u_{\text{bus}}(h_{\text{bus}}) + u_{\text{trash}}(h_{\text{trash}}) + u_{\text{fork}}(h_{\text{fork}})$$

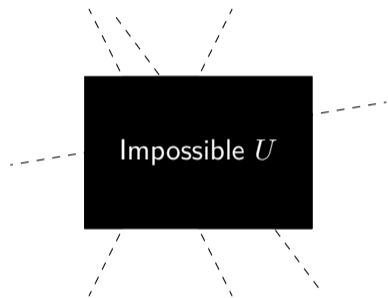
Active elicitation



Active elicitation



Inconsistencies during active elicitation



It can happen as the DM :

- Has **incomplete and uncertain** preferences
- can make mistakes
- is not aligned with the DA's model

But he has to be convinced by the final recommendation!

Objective

Formalise the DA

- Conduct an active elicitation
- Produce explanations
- Tolerant to inconsistencies
- Contestable?



We present dialogue game scenarios between the DM and the DA

Possibilistic reminders

Possibilistic encapsulation [Adam and Destercke, 2024]

Definition (Possibilistic base)

$$\Gamma = \{(\phi^{(1)}, \alpha^{(1)}), \dots, (\phi^{(m)}, \alpha^{(m)})\}$$

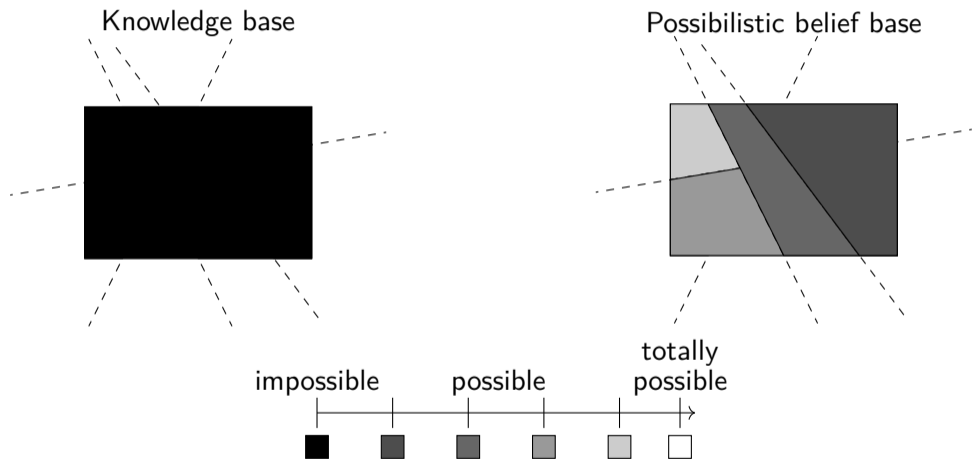
With $\alpha^{(j)} \in]0, 1]$, degree of certainty and $\phi^{(j)}$ **linear inequality**.

The α induce a pre-order on the preferential belief of the base

Definition (Strata of Γ)

$\Gamma = S_1 \cup \dots \cup S_l$ where each S_1 contains the most certain belief in Γ and S_l the least certain

Possibilities extend the flat base case



Semantic of $\alpha^{(j)}$

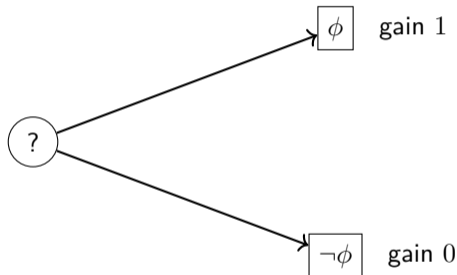
Ordinal

Pre-order between the different layers

0.6 : $\phi^{(1)}$

0.4 : $\phi^{(2)}$

Cardinal



$\alpha^{(j)}$ is the maximum price of a ticket for this game.

Possibilistic syntaxes for inference [Benferhat et al., 1999]

$$\Gamma = S_1 \cup S_2 \cup S_3 \cup S_4$$
$$\{\phi^{(1)}\} \quad \{\phi^{(2)}, \phi^{(3)}\} \quad \{\phi^{(4)}\} \quad \{\phi^{(5)}, \phi^{(6)}\}$$

- Possibilistic inference mechanism associates a degree with each deduction
- Build a consistent sub-base Γ^* following a deterministic mechanism
- Some approaches remain tractable on a linear base [Gaudillier et al., 2025]
- The MCS/MIS approaches are more complex and more expressive

Explaining a recommendation

Explanation via covers [Amoussou et al., 2025]

Decompose the preference between alternatives in a chain of preference between subset of criteria

Ratz (7 \$ 4 ☆ 8 🚌 4 🗑 4 🍴) \succ Formula Hun (5 \$ 6 ☆ 5 🚌 6 🗑 6 🍴)

because, for all **(or some !)** totally possible U

$$U(8 🚌 4 🗑 4 🍴) \geq U(5 🚌 6 🗑 6 🍴)$$

and

$$U(7 $ 4 ☆) \geq U(5 $ 6 ☆)$$

Dialogue game scenarios

Why? locution: mixed-initiative dialogue [Horvitz, 1999]



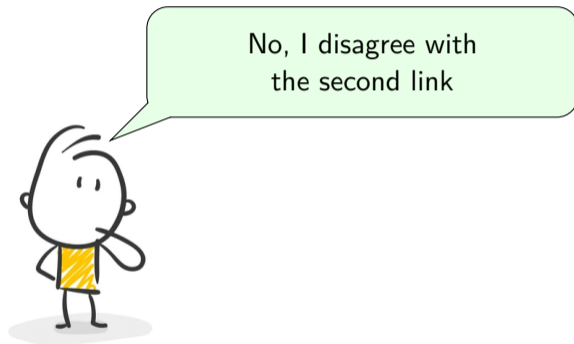
Hybrid locutions for explanation and elicitation

Everything else being equal, you prefer ($\star:7$, $\text{bus}:8$, $\text{\$}:4$) over ($\star:4$, $\text{bus}:3$, $\text{\$}:7$) at a certainty of \blacksquare

However, I need to formulate a hypothesis to claim that you prefer ($\text{cup}:4$, $\text{fork}:4$) over ($\text{cup}:3$, $\text{fork}:5$). Do you agree?



Contestation



Conclusion

Conclusion

By combining decision theory, possibility theory and an explanation motor, we create a promising framework in which formalise a dialogue game between a DM and a virtual DA. The next steps of this work are :

- Formalise the dialogue game
- Implement such a framework
- Evaluate its impact on the recommendation process

References



Adam, L. and Destercke, S. (2024).
Handling inconsistency in (numerical) preferences using possibility theory.
[Information Fusion](#), (103):102089.



Amoussou, M., Belahcene, K., Maudet, N., Mousseau, V., and Ouerdane, W. (2025).
Designing and computing explanations for comparisons inferred from an additive value model.
[European Journal of Operational Research](#).



Benferhat, S., Dubois, D., and Prade, H. (1999).
An overview of inconsistency-tolerant inferences in prioritized knowledge bases.
[Fuzzy Sets, Logic and Reasoning about Knowledge](#), (15):395–417.



Gaudillier, A., Belahcène, K., Ouerdane, W., and Sébastien, D. (2025).
Possibilistic logic and inference for linear systems.
In Sauerwald, K. and Thimm, M., editors, [Symbolic and Quantitative Approaches to Reasoning with Uncertainty](#), Cham. Springer International Publishing.



Horvitz, E. (1999).
Uncertainty, action, and interaction: In pursuit of mixed-initiative computing.
[Intelligent Systems](#), pages 17–20.

Thanks !

Mixed-initiative scenarios for recommendations and explanations with defeasible inferences, *Armand Gaudillier, Khaled Belahcène, Wassila Ouerdane, Sébastien Destercke*