

# Challenges for Responsible Recommender Systems

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# Recommender Systems

Recommender systems (RS) support the decision-making of humans

- RS serve an intended purpose
  - e.g. Amazon, Netflix, TikTok, booking.com
- RS boost consumption → not always desired
  - For example in tourism: overtourism, CO2 emissions etc.
  - But also opportunities to promote under-utilized destinations and venues
- *“responsible” RS → serve “good” purpose, how systems should behave*

Goal: Subjective view on current challenges (principles) for responsible (ethical, sustainable, ...) recommender systems

- Preliminary examples for user interaction

# Principles for Responsible RS

Multistakeholder fairness

User control, transparency and explainability

Beyond accuracy: diversity and filter bubbles

Privacy and personal data protection

*Other principles are considered, but for example accountability not as important for RS?*

# Fairness in RS

## Recent literature on fairness in RS

- Wang, Y., Ma, W., Zhang, M., Liu, Y., & Ma, S. (2023). A Survey on the Fairness of Recommender Systems. *ACM Transactions on Information Systems*, 41(3), 1-43
- Li, Y., Chen, H., Xu, S., Ge, Y., Tan, J., Liu, S., & Zhang, Y. (2023). Fairness in Recommendation: Foundations, Methods, and Applications. *ACM Transactions on Intelligent Systems and Technology*, 14(5), 1-48
- Deldjoo, Y., Jannach, D., Bellogin, A., Difonzo, A., & Zanzonelli, D. (2024). Fairness in Recommender Systems: Research Landscape and Future Directions. *User Modeling and User-Adapted Interaction*, 34(1), 59-108.
- Knees, P., Neidhardt, J., Nalis, I. (2024). Recommender Systems: Techniques, Effects, and Measures Toward Pluralism and Fairness. In: Werthner, H., et al. *Introduction to Digital Humanism*. Springer, Cham.
- ...

# Multistakeholder Fairness in Tourism RS

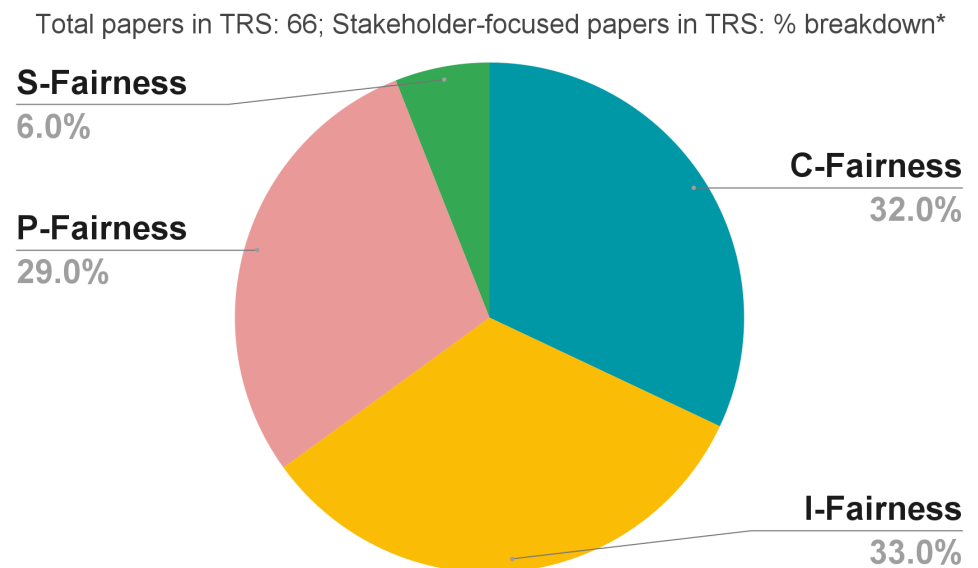
Multistakeholder RS is considered to be fair if it minimizes any bias or circumstance that may result in disfavored outcomes for any stakeholder (class)

- Consumers, item providers, platform, society

Societal fairness (S-Fairness):

impact on non-participating stakeholders (society), such as local communities

Survey Paper: [Banerjee, A., Banik, P., & Wörndl, W. (2023) A Review on Individual and Multistakeholder Fairness in Tourism Recommender Systems. Frontiers in Big Data, Vol. 6]



From\*

Amsterdam, Netherla... ▾

Month

June



Interests

Cultural, Culinary, Historical, Entert... ▾

EXPLORE

Green Recommended

19/100



### Brussels, Belgium 🇧🇪

Brussels is the capital of Belgium and the European Union, known for its ornate buildings, chocolates, and waffles.

Technology Sports Religious Adventure

Emission

Popularity

Seasonality

-82% CO<sub>2</sub>e



Traffic

Quiet



23 kg CO<sub>2</sub>e

2 hr 26 min



29 kg CO<sub>2</sub>e

0 hr 40 min

## Generating Sustainable Recommendations

- Emissions estimated for reaching the destination (*emissions index*)
- Popularity of the destination (*popularity index*)
- How crowded the destination is for the selected month (*seasonality index*)
- Overall score based on the weighted sum of the above components
- Lower score, more sustainable

[Ashmi Banerjee, Tunar Mahmudov, Wolfgang Wörndl:

Green Destination Recommender: A Web Application to Encourage Responsible City Trip Recommendations. Workshop on Personalized Access to Cultural Heritage (PATCH), ACM UMAP 2024, Cagliari, Italy, Jul. 2024.]

# Principles for Responsible RS

## Multistakeholder fairness

- Societal fairness
  - Model sustainability goals, integrate in recommendation process (→ Pavel)
  - Incentivize commercial systems
- Fairness in RS based on LLMs (→ Yashar)
  - Local knowledge can be utilized to encode sustainability or fairness goals

## User control, transparency and explainability

# RS Transparency in DSA

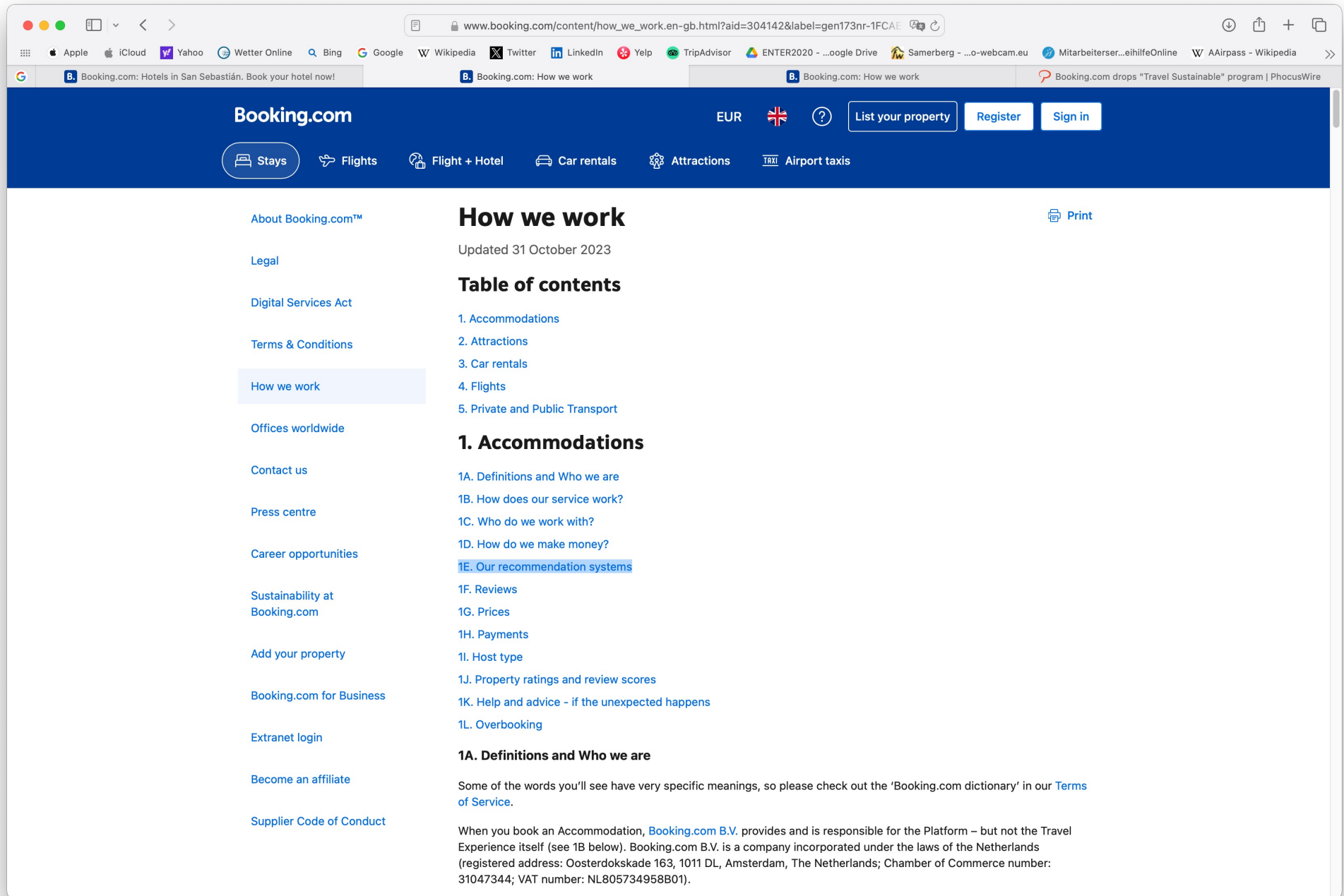
EU Digital Services Act (DSA) specifically addresses recommender systems transparency:

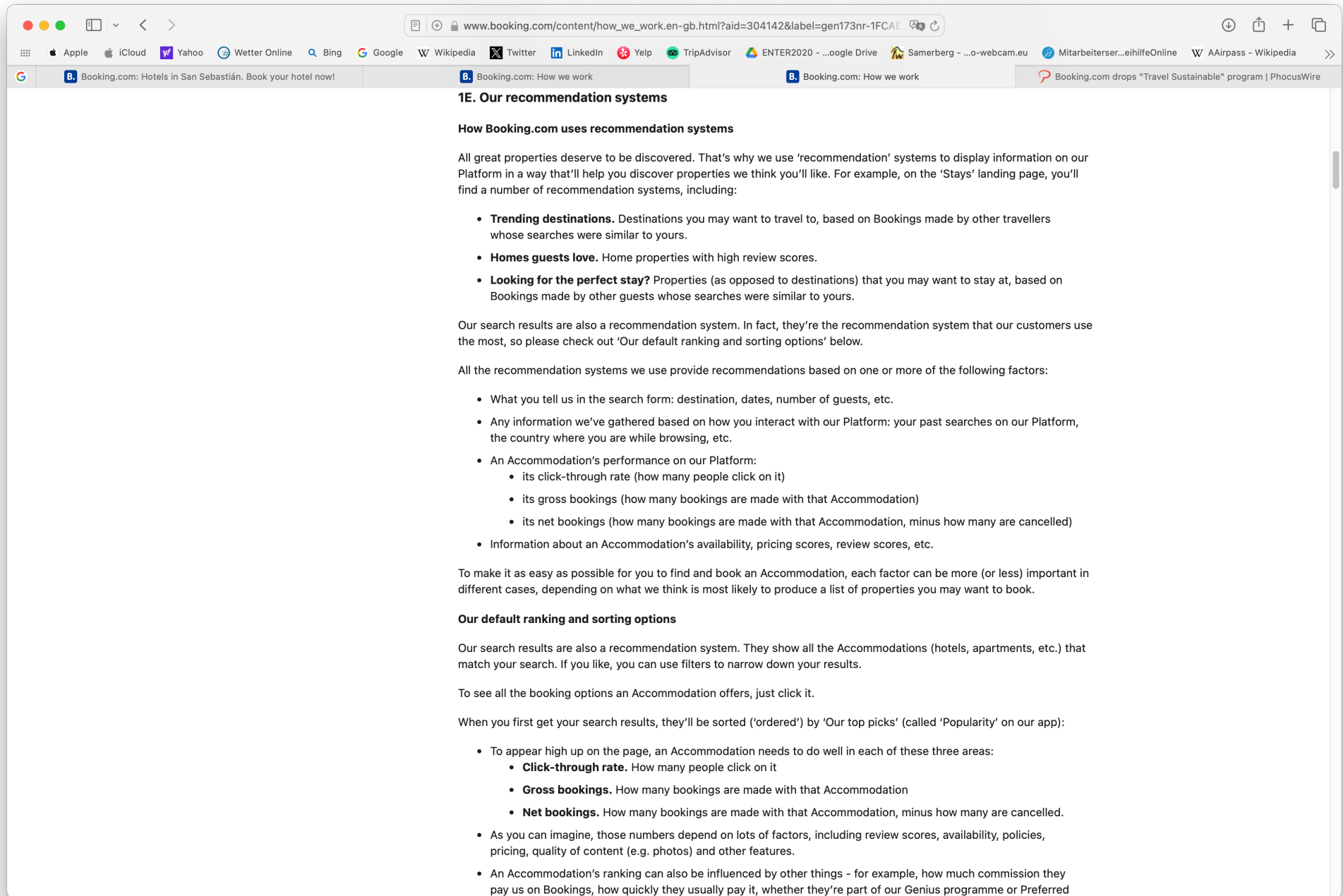
## *Article 27 Recommender system transparency*

1. Providers of online platforms that use recommender systems *shall set out in their terms and conditions*, in plain and intelligible language, the *main parameters used in their recommender systems*, as well as any *options for the recipients of the service to modify or influence those main parameters*.
2. The main parameters referred to in paragraph 1 shall explain why certain information is suggested to the recipient of the service. They shall include, at least:
  - (a) the criteria which are most significant in determining the information suggested to the recipient of the service;
  - (b) the reasons for the relative importance of those parameters.
3. Where several options are available pursuant to paragraph 1 for recommender systems that *determine the relative order of information presented to recipients* of the service, providers of online platforms shall also make available a functionality that allows the recipient of the service to select and to modify at any time their preferred option. That functionality shall be directly and easily accessible from the specific section of the online platform's online interface where the information is being prioritised.

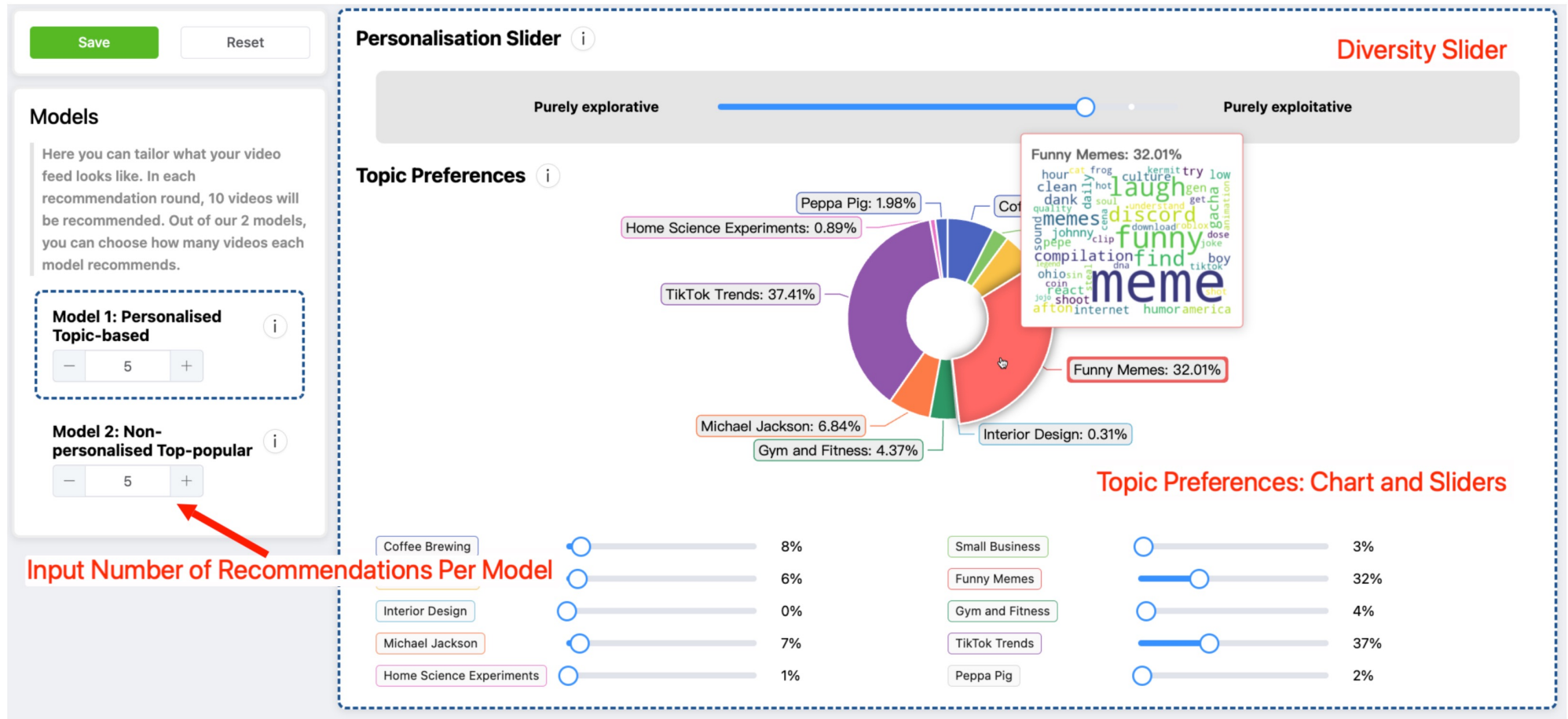
[<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R2065>,  
*blue highlighting added by myself*]







User control for short video recommendations, data from YouTube, features include like/dislike (+ „why not“?) on videos, explanations and detailed control options:



[Jingyi Jia, Matteo Fabbri, Wolfgang Wörndl:

## Enabling users' control on recommender systems for short videos:

a design proposal for the implementation of the requirements of the Digital Services Act.

EWAF'24: European Workshop on Algorithmic Fairness, Mainz, Germany, Jul. 2024]

# Principles for Responsible RS

Multistakeholder fairness

User control, transparency and explainability

- More focus on user interaction with RS, including LLM prompts etc.
- Explanations are well-researched for RS, but AI techniques are usually black-box, reasoning difficult to explain
- Requirements of the Digital Services Act (DSA)
  - Modify RS parameters and influence strategies → how can this be done with more complex models or RS using LLM/Gen. AI?

# Principles for Responsible RS

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Beyond accuracy: diversity and filter bubbles

- Other side of "user control" coin
- Avoid filter bubbles, metrics such as diversity, serendipity etc.
- Research often focused on user side, but also effect on items, or other stakeholders
- Some frameworks and approaches, for example

[Smets, A., Michiels, L., Bogers, T., & Björneborn, L. Serendipity in recommender systems beyond the algorithm: A feature repository and experimental design. IntRS'22: Joint Workshop on Interfaces and Human Decision Making for Recommender Systems, RecSys 2022]

- RS using LLM/Gen. AI may increase negative effects

# Principles for Responsible RS

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Beyond accuracy: diversity and filter bubbles

Privacy and personal data protection

- Decentralized (mobile?) recommender system
  - Tradeoff between accuracy and privacy
- Separate recommendation and personalization
  - LLMs does not contain user model (prompts, tool-augmented LLM)
  - User model could be added as local knowledge, under control of user
- Privacy very subjective/personal concept → user perspective

*More work needed on user interaction with responsible RS!*