

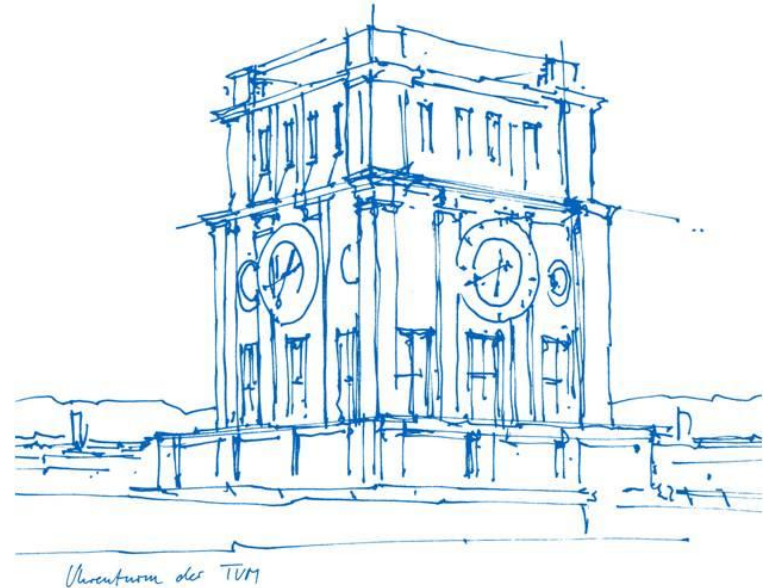
# Multistakeholder Recommender Systems in Tourism

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# Multistakeholder Recommendation and Tourism

- Tourism recommenders: good candidate to explore **multistakeholder aspects**.
- Tourism is susceptible to **outside influences** and **multi-party utilities**.
- **Stakeholder**: a party with a vested interest in the outcome of the recommendation process.
- **Utility**: degree of success in achieving the objective(s).
  - **Consumer** (also: user): end user of the recommendation system.
  - **Provider**: manufacturers/providers of the items recommended.
  - **System**: parties providing the recommender service and apparatus.
  - **Society**: outside environment at large.

Stakeholders →

# Research Objectives

1. Explore the **effects of other stakeholders** on the recommendation process from the end-user's point of view.
2. Map the **impact of external factors** on multistakeholder recommender systems.

Studied with **tourism recommendation** as the overarching theme.

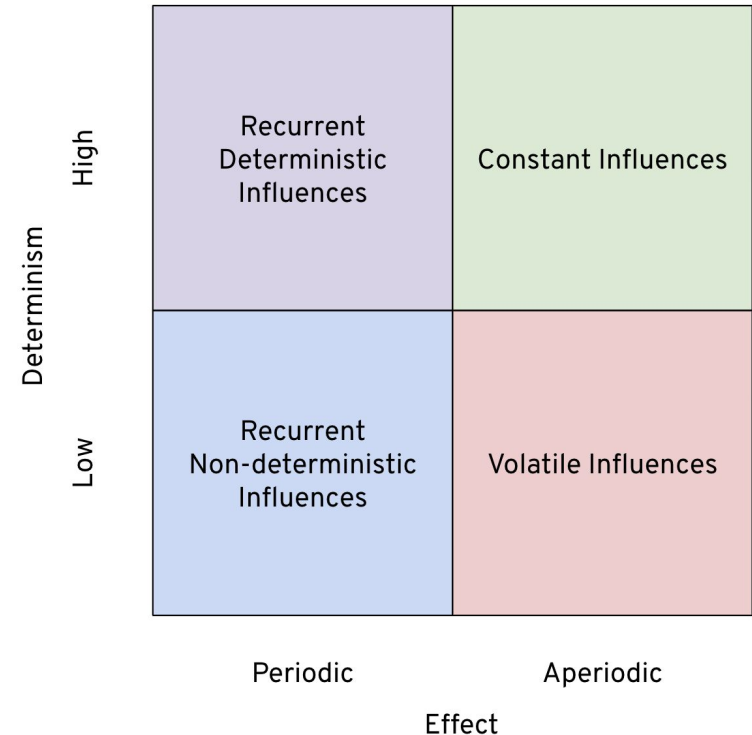
Method of investigation: user study, with synthetic recommendations.

# Non-functional Influences

Introducing a categorisation of external influences affecting recommendation parameters for each stakeholder:

- **Constant**: prescriptive, predictable.
- **Recurrent deterministic**: periodic, predictable.
- **Recurrent non-deterministic**: periodic, hard to predict.
- **Volatile**: aperiodic, hard to predict.




In tourism, all of the above can play a crucial role in the recommendation process.






# Experiment: Part 1

- Reranking Airbnb listings with focus on different utilities.
- **Motivation:** Investigate the effects of multistakeholder utilities affecting the end user.
- Initially – increased user utility: close to centre, less price per head, good ratings.
- Subsequently:
  - Provider utility: higher price per square feet.
  - Societal utility: excluding tourist hotspots (Centrum).
  - System utility: most booked places (higher likelihood of booking).
- Users rated their satisfaction on a 1-5 scale.

# Reranking Airbnb Listings Example: User Utility

		
<b>Bright apt in central Amsterdam</b>	<b>Central 17th Century Unique House</b>	<b>Top Location Triple Room</b>
Entire apartment 4 guests · 1 bedroom · 2 beds · 1 bath	Entire house 2 guests · 3 bedroom · 2 beds · 2 baths	Private room in apartment 3 guests · 1 bedroom · 2 beds · 2 baths
★ 4.79      131 reviews	★ 4.97      31 reviews	★ 4.84      65 reviews
Amsterdam Centrum, Amsterdam, NL 0.1 km from City Centre	Amsterdam Centrum, Amsterdam, NL 0.1 km from City Centre	Amsterdam Centrum, Amsterdam, NL 0.2 km from City Centre
Kitchen TV Smoke Alarm	Indoor fireplace Wi-Fi High chair	Wi-Fi Heating First aid kit
Washer Dryer Wi-Fi	Kitchen Washer Dryer	Washer Smoke Alarm Essentials
Offered by Rudolf <b>53€</b>	Offered by Milen & Joes <b>44€</b>	Offered by Tonino <b>53€</b>

# Reranking Airbnb Listings Example: Societal Utility

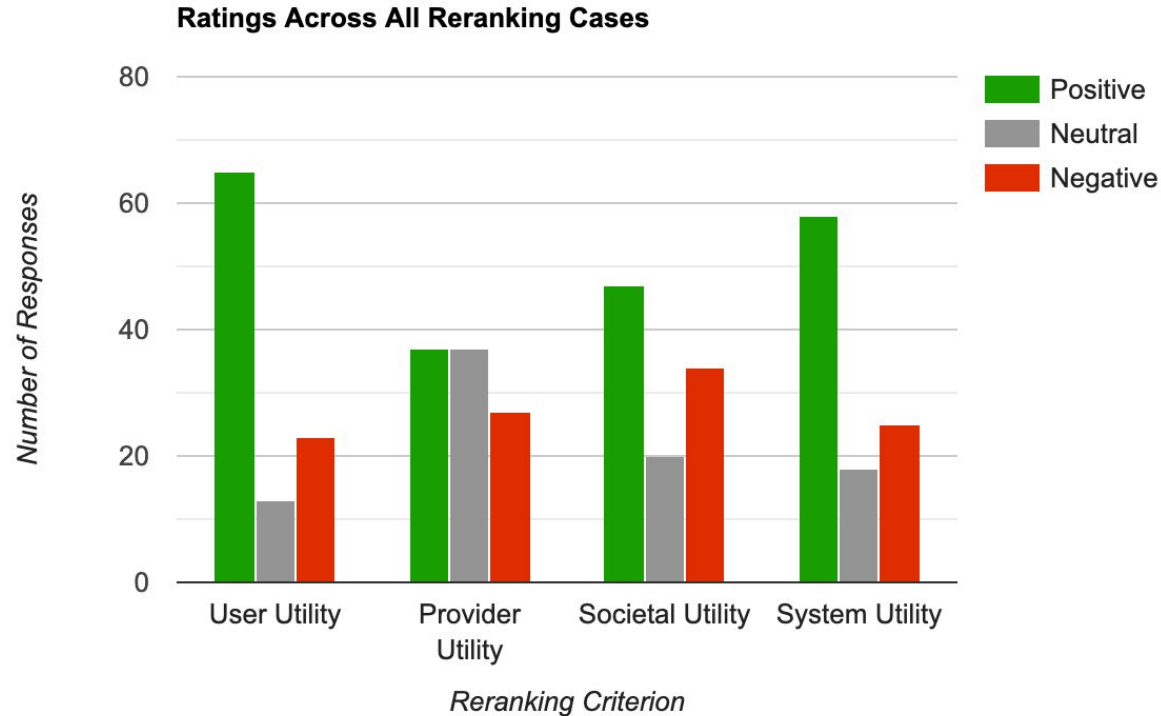
		
<p><b>Cozy apartment on houseboat</b></p>	<p><b>Great spacious family apartment</b></p>	<p><b>Historic canal house near CS</b></p>
<p>Private room in boat 2 guests · 1 bed · 1 private bath</p>	<p>Entire apartment 4 guests · 3 bedrooms · 3 beds · 1 bath</p>	<p>Entire loft 3 guests · 1 bedroom · 2 beds · 2 baths</p>
<p>★ 4.68 158 reviews</p>	<p>★ 4.90 33 reviews</p>	<p>★ 4.93 46 reviews</p>
<p>Indische Buurt, Amsterdam, NL 2.0 km from City Centre</p>	<p>De Pijp, Amsterdam, NL 2.1 km from City Centre</p>	<p>De Pijp, Amsterdam, NL 2.2 km from City Centre</p>
<p>Kitchen Smoke alarm Hair dryer</p> <p>Wi-Fi Essentials Heating</p>	<p>Cable TV Wi-Fi High chair</p> <p>Kitchen Washer Dryer</p>	<p>Kitchen Essentials Workspace</p> <p>Wi-Fi Smoke Alarm Paid parking</p>
<p>Offered by Annemarie 50€</p>	<p>Offered by Niels 69€</p>	<p>Offered by Irene 57€</p>

## Experiment Design: Part 2

- Studying users' views on multistakeholder recommender systems.
- **Motivation:** Gauge how the users believe a multistakeholder recommender system should behave.
- Sample questions:
  - As a user, a recommender system should prioritise my needs over other parties.
  - A recommender system should tell me when interests of other parties are taken into account.
- Additionally: 3 scenarios from the non-functional influences.
  - Should the recommender system help?



# Results: Reranking Airbnb Listings



## Results: Reranking Airbnb Listings



## User utility

Close to centre, less price per head, good ratings



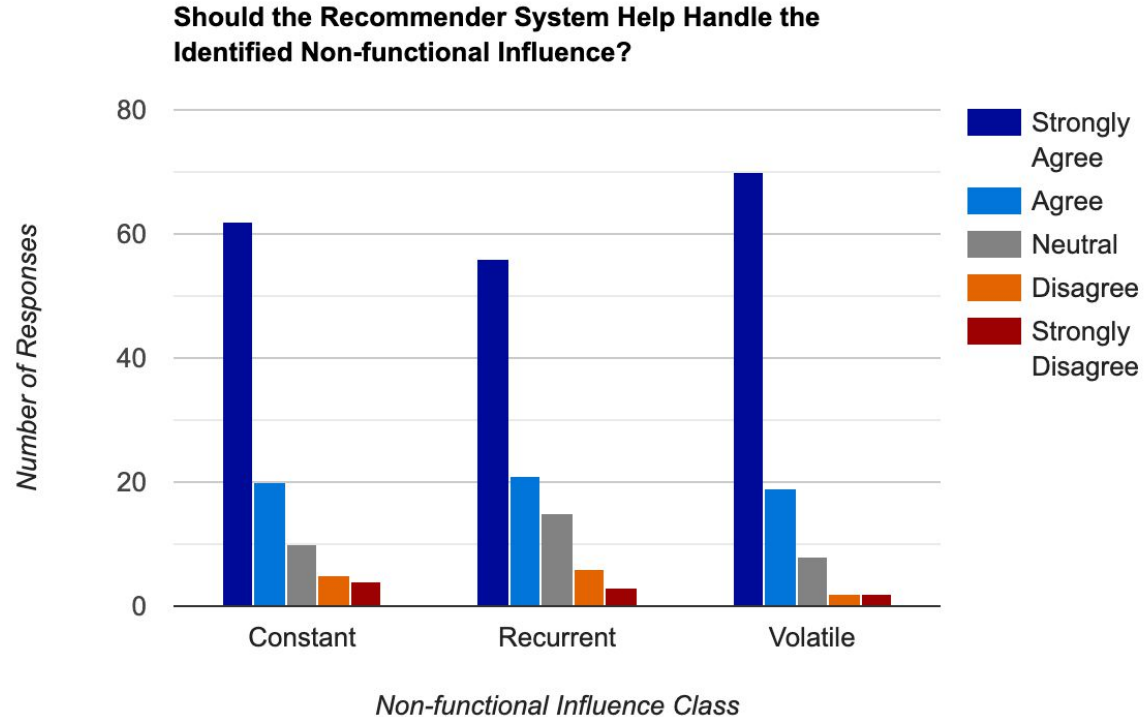
## Provider utility

Higher price per square feet

# User Views on Multistakeholder Recommender Systems

Question (abridged)	Agree	Neutral	Disagree
I prefer to use recommender systems for tourism	58	26	17
Sometimes my results may be affected by other factors	74	18	9
Recommender systems should prioritise my needs	76	13	12
I should know when other parties' interests are affecting my results	82	14	5
My data can be used to benefit other parties	84	9	8

# Non-functional Influences



# Conclusions

- End users are sensitive to other stakeholders' interests affecting their outcomes.
- Users desire more transparency and openness.
- Multistakeholder aspects of tourism is a **less-explored** area in literature, but one that is important.
- Non-functional influences: **never formally characterised** for multistakeholder recommender systems.
- Main challenge: scattered data and heterogeneous systems.



<https://gokul.github.io/msr-tourism>