Argumentative explanations for recommendations - Effect of display style and profile transparency

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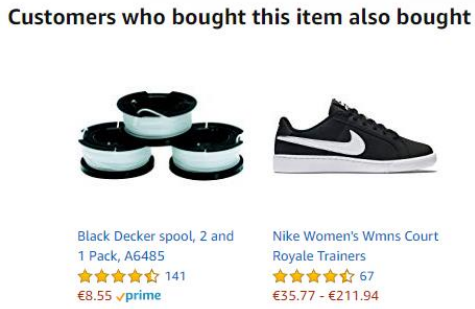
Motivation

- **Transparency** and **effectiveness** of RS may be increased when **explanations are provided** [Tintarev and Masthoff. 2012].

- To go beyond this!

or this



  - Our proposal: an **argument-based approach** to generate verbal and graphic-based explanations.
  - Our particular aim: To test the effect of different presentation styles on users' perception.

Exploiting of online reviews in explainable RS

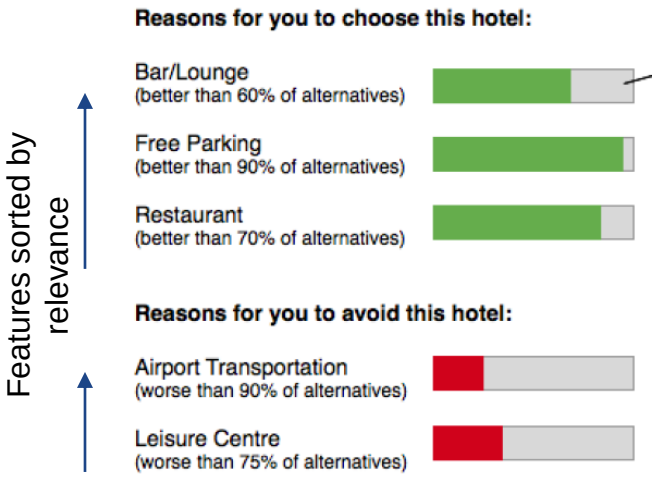
- Abstractive **summaries of opinions** using natural language generation (NLG) techniques [Costa et al. 2018].
- Joint deep modeling of items and users from reviews [Zheng et al. 2017]. Use of attention mechanism to extract **useful reviews** [Chen et al. 2018].
- A **feature-based** summarized view of pros and cons reported by customers, leveraging aspect-based sentiment detection, e.g. matrix factorization explanatory model by [Zhang et al. 2014]

From: https://blog.ad7.io/

Review-based explanations in RS

"You might be interested in [feature], on which this product performs well"

(Zhang et al. 2014)



(Muhammad et al. '16)

It is located in the vicinity of Main Square, and provides free Wi-Fi access, AC and free breakfast. 92% of visitors reported positive comments about cleanliness and 87% about location. Some visitors mentioned negative comments about cleanliness (10%), however such claims are seemingly related to particular incidents rather than a usual situation, or perhaps to very high expectations that were not met. Therefore, this hotel seems to be a very good option for you.

Features selected by relevance

(Hernandez-Bocanegra et al. 2020)

(Wu and Ester 2016)

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User profile transparency in RS

Your prediction is based on how MovieLens thinks you like these aspects of the film:

Relevance		Your preference
	alfred hitchcock	★★★★½
	classic	★★★★½
	afi 100	★★★★½
	imdb top 250	★★★★
	murder	★★★★
	tense	★★★★
	noir thriller	★★★★

(Vig et al. 2009)

Your rating for similar movies

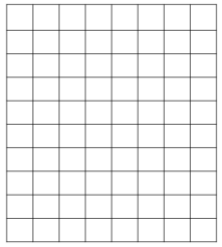
(Abdollahi and Nasraoui 2017)

Explanatory RS method

Explicit Factor Model (EFM), Zhang et al. 2014
Based on Matrix Factorization, incorporates user reviews.
Aim: align latent and explicit features.

n=8 (items)

m=10 (users)

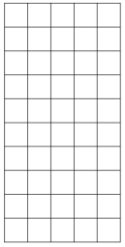


Rating Matrix (A)

$$\underset{P,Q}{\text{minimize}} \left\{ \|PQ^T - A\|_F^2 \right\}$$

p=5 (explicit features)

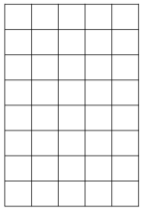
m=10 (users)



User preference Matrix (X)
(how many times user talk about a feature)

p=5 (explicit features)

n=8 (items)



Item quality matrix (Y)
(how many positive / negative comments about a feature)

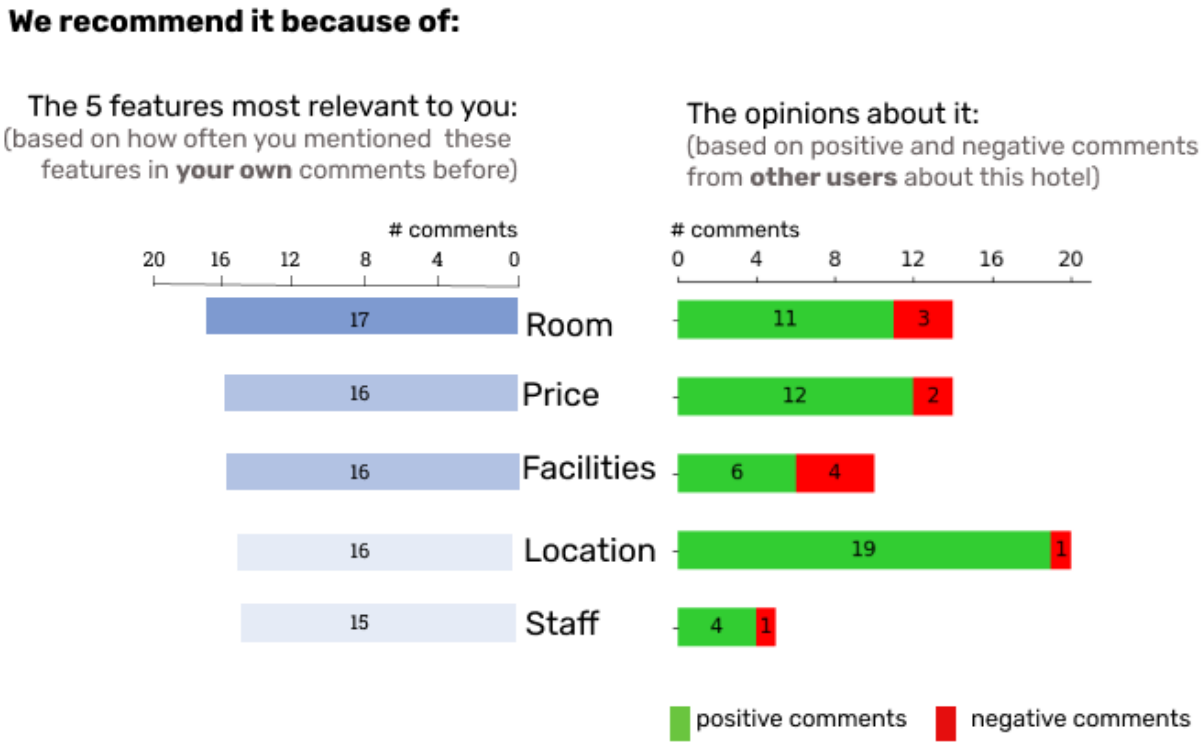
$$\underset{U_1,U_2,V}{\text{minimize}} \left\{ \lambda_x \|U_1 V^T - X\|_F^2 + \lambda_y \|U_2 V^T - Y\|_F^2 \right\}$$
$$\text{s.t. } U_1 \in \mathbb{R}_+^{m \times r}, U_2 \in \mathbb{R}_+^{n \times r}, V \in \mathbb{R}_+^{p \times r}$$
$$P = [U_1 \ H_1] \qquad Q = [U_2 \ H_2]$$

Optimization task:

$$\underset{U_1,U_2,V,H_1,H_2}{\text{minimize}} \Big\{ \|PQ^T - A\|_F^2 + \lambda_x \|U_1 V^T - X\|_F^2 + \lambda_y \|U_2 V^T - Y\|_F^2 + \lambda_u (\|U_1\|_F^2 + \|U_2\|_F^2) + \lambda_h (\|H_1\|_F^2 + \|H_2\|_F^2) + \lambda_v \|V\|_F^2 \Big\}$$
$$\text{s.t. } U_1 \in \mathbb{R}_+^{m \times r}, U_2 \in \mathbb{R}_+^{n \times r}, V \in \mathbb{R}_+^{p \times r}, H_1 \in \mathbb{R}_+^{m \times r'},$$
$$H_2 \in \mathbb{R}_+^{n \times r'} \text{ and } P = [U_1 \ H_1], \ Q = [U_2 \ H_2]$$

Explanation template:
“You might be interested in [feature], on which this product performs well”.

Explanation design proposal



Explanation provided in user study
(condition style ‘visual’, user preferences ‘yes’)

Explanation design proposal

We recommend it because of:

The opinions about this hotel (based on positive and negative comments from **other users**) about the 5 features most relevant to you (based on how often you mentioned these features in **you own** comments before):

Relevance	Feature	# Comments (other users)	Positive	Negative	# Comments (yours)
1.	Room	14	79%	21%	17
2.	Price	14	86%	14%	16
3.	Facilities	10	60%	40%	16
4.	Location	20	95%	5%	15
5.	Staff	5	80%	20%	15

Explanation provided in user study
(condition style 'text', user preferences 'yes')

Research questions

In regard to quality of explanation, and the explanatory aims of transparency, effectiveness, efficiency and trust:

- RQ1: Does the **display style** of explanation (using charts or only text) influence the perception of the variables of interest?
- RQ2: Does including or not the information about **user preferences** influence the perception of the variables of interest?
- RQ3: Do individual differences in **decision making styles**, **social awareness** or **visualization familiarity** influence the perception of these variables when the proposed explanations are provided?

Empirical study

x 152
(AMT workers)

2x2 between-subjects design

2 Display styles, 2 user preferences display (yes, no)

Perception assessment

Variables: Explanation quality, transparency, effectiveness, efficiency, trust

Covariates

User characteristics: Decision making style, social awareness, visualization familiarity

Empirical study

a)

We recommend it because of:

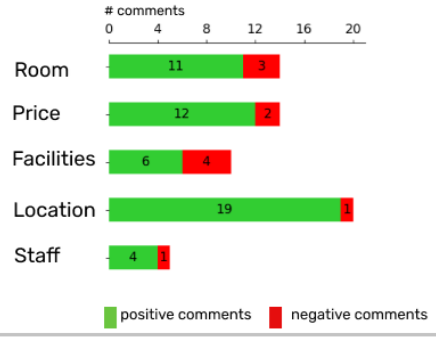
The 5 features most relevant to you:
(based on how often you mentioned these features in **your own** comments before)

The opinions about it:
(based on positive and negative comments from **other users** about this hotel)

b)

We recommend it because of:

The opinions about it:
(based on positive and negative comments from **other users** about this hotel)



Display style 'visual'

c)

We recommend it because of:

The opinions about this hotel (based on positive and negative comments from **other users**) about the 5 features most relevant to you (based on how often you mentioned these features in **you own** comments before):

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User preferences 'yes'

d)

We recommend it because of:

The opinions about this hotel (based on positive and negative comments from **other users**)

Feature	# Comments (other users)	Positive	Negative
Room	14	79%	21%
Price	14	86%	14%
Facilities	10	60%	40%
Location	20	95%	5%
Staff	5	80%	20%

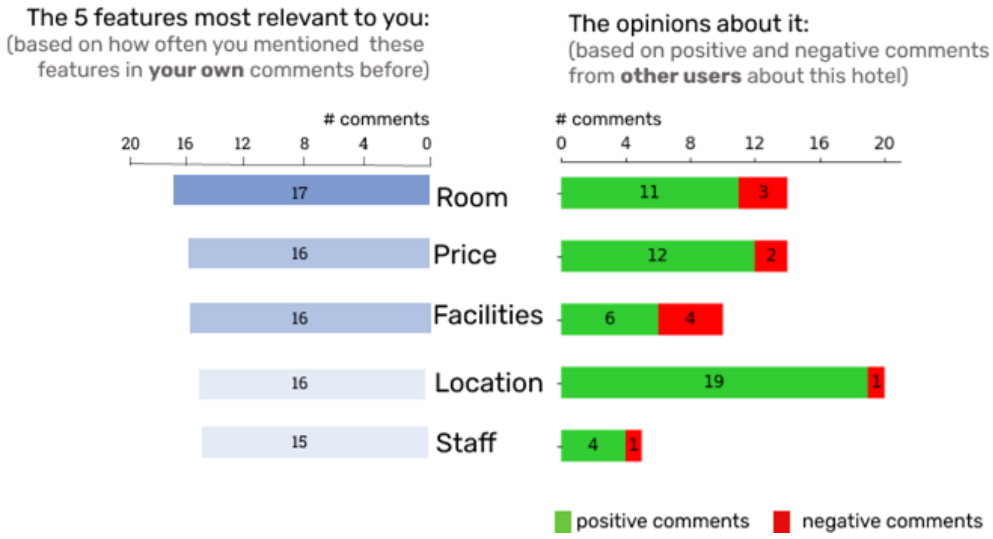
Display style 'text'

User preferences 'no'

Empirical study, experimental conditions

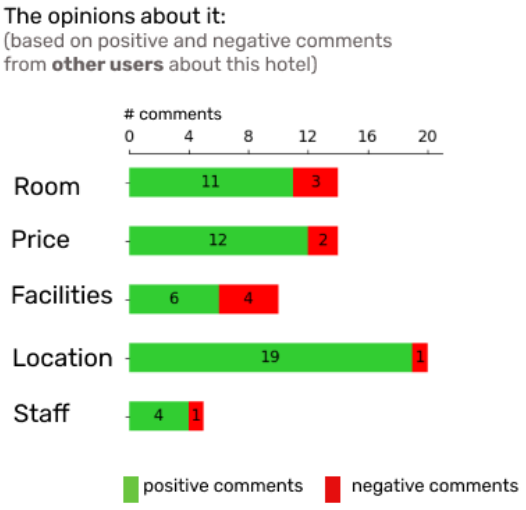
Empirical study: Results

No main effects of the **display of user preferences** were found



Transparency, User preferences ‘yes’
(M=3.87, SD=0.71)

VS



Transparency, User preferences ‘no’
(M=3.72, SD=0.79)

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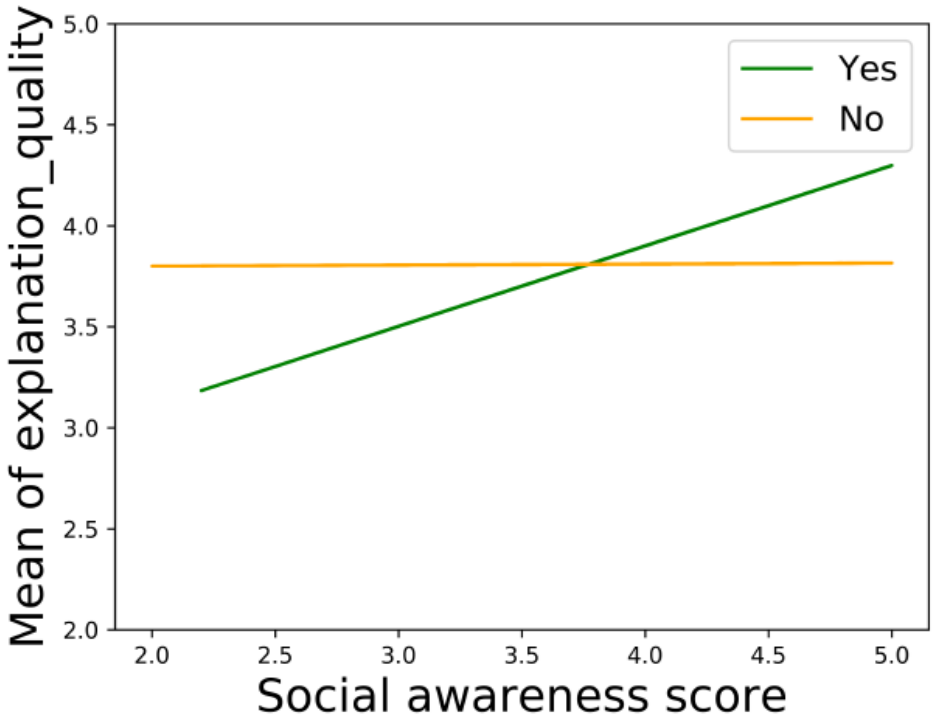
Empirical study: Results

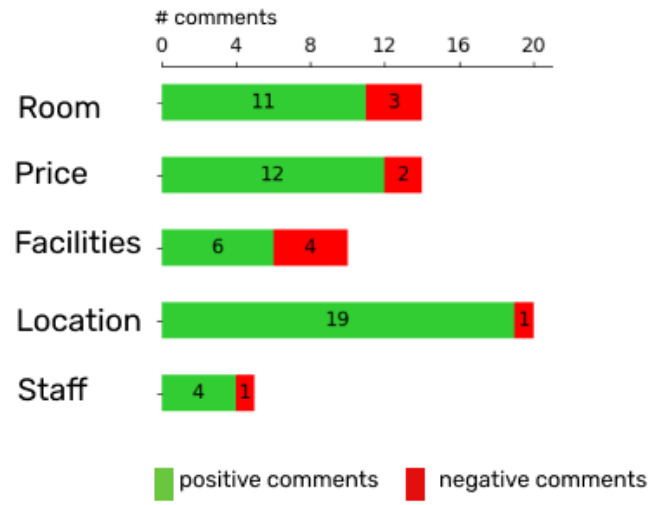
A significant interaction between social awareness and the display of user preferences was found ($F(1, 146) = 4.79, p<.05$).



Empirical study: Results

No main effects of the **display style** or **visualization familiarity** were found

The opinions about it:
(based on positive and negative comments from **other users** about this hotel)



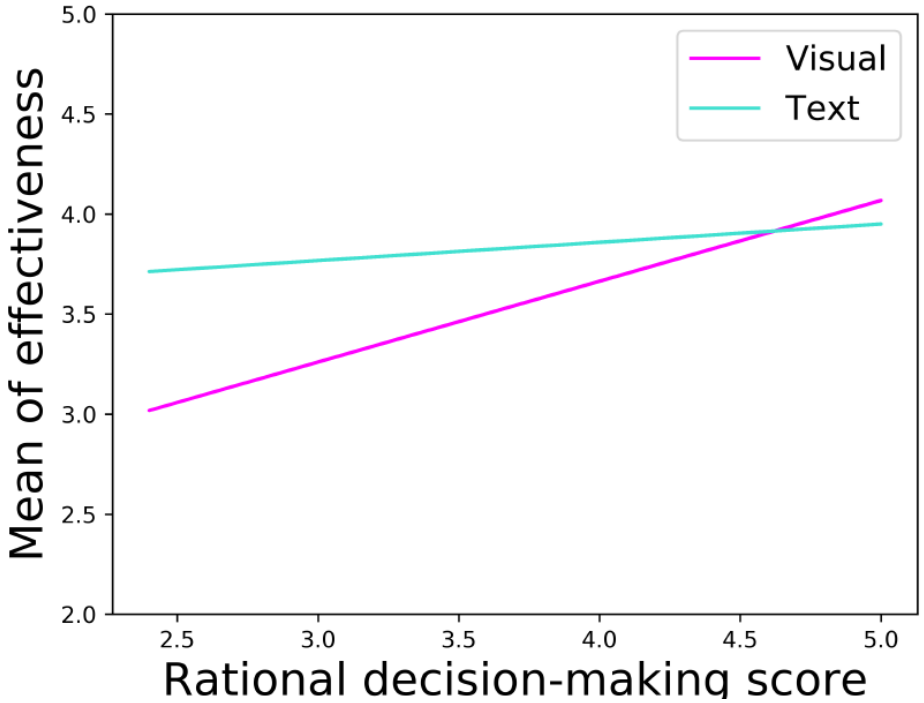
VS

The opinions about this hotel (based on positive and negative comments from **other users**)

Feature	# Comments (other users)	Positive	Negative
Room	14	79%	21%
Price	14	86%	14%
Facilities	10	60%	40%
Location	20	95%	5%
Staff	5	80%	20%

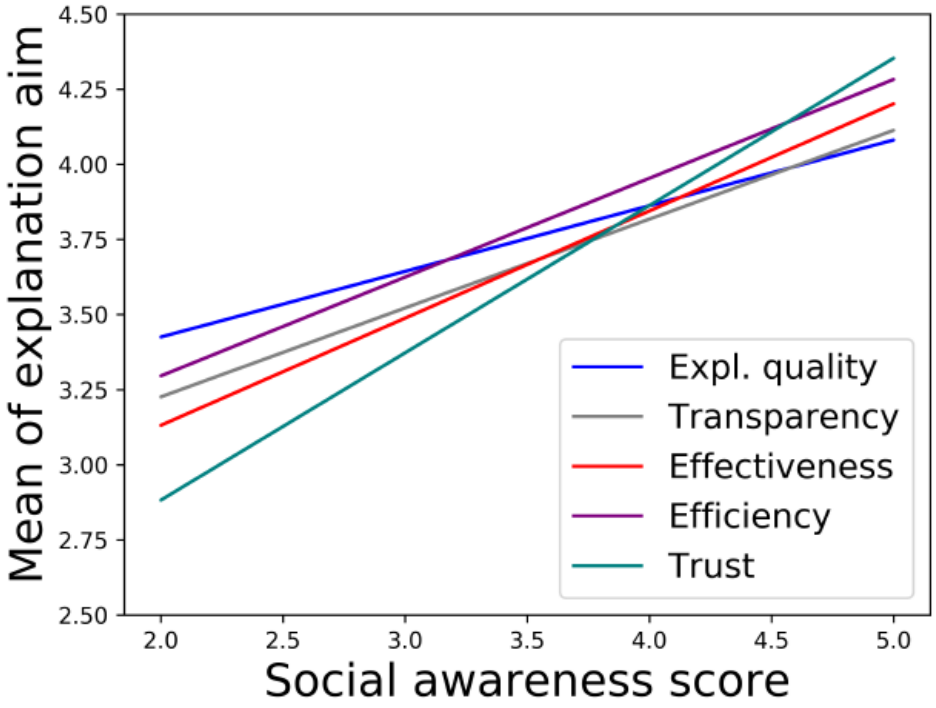
Empirical study: Results

A possible interaction effect between rational-decision making style and display style on effectiveness ($F(2, 146)=2.82$, $p=.09$).



Empirical study: Results

A main effect of social awareness was found on all our variables of interest



Limitations

- Use of a prototype, were users actual preferences could not be requested or detected.
- Use of AMT platform, where choices are hard to motivate.

Social awareness and rational decision-making style influence the perception of review-based RS, in regard to different display styles and profile transparency.

Thank you for your attention!