TasteWeights

A Visual Interactive Hybrid Recommender System

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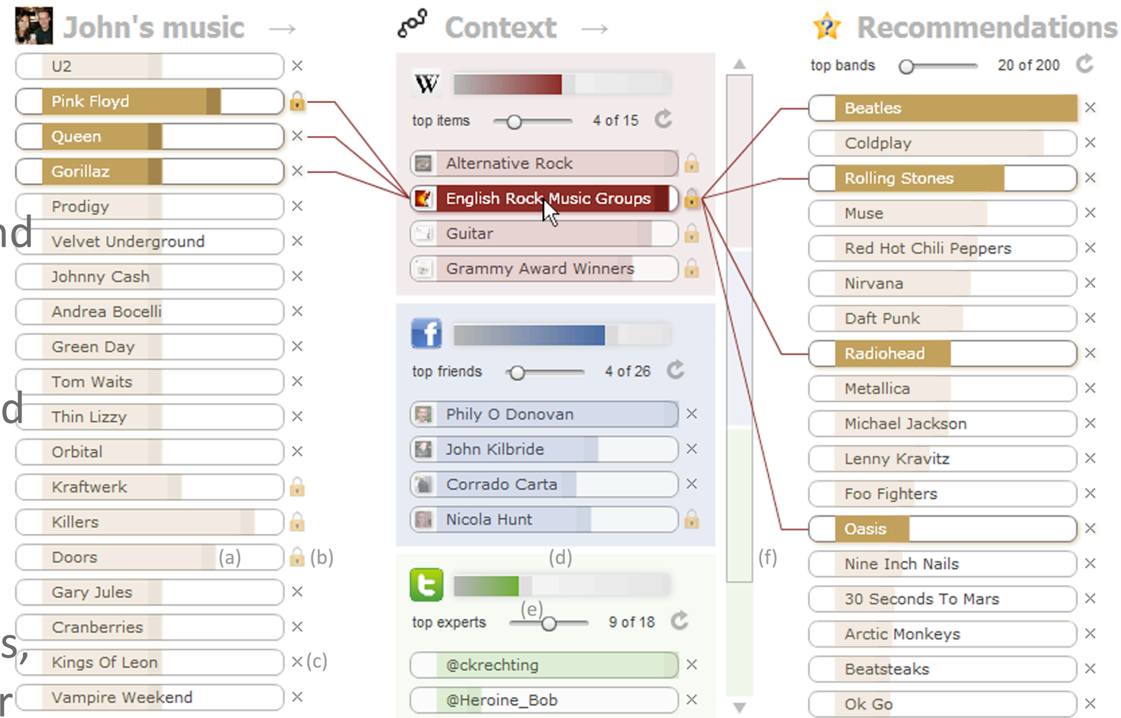
Motivation

Problems

- Many traditional recommenders are “black boxes” and lack explanation and control [Herlocker]
- “Why am I being recommended this movie? I don’t like horror films.”
- Even in modern recommenders, data can be static, outdated or simply irrelevant from the beginning.
- Data about users and items is spread far and wide.



Motivation

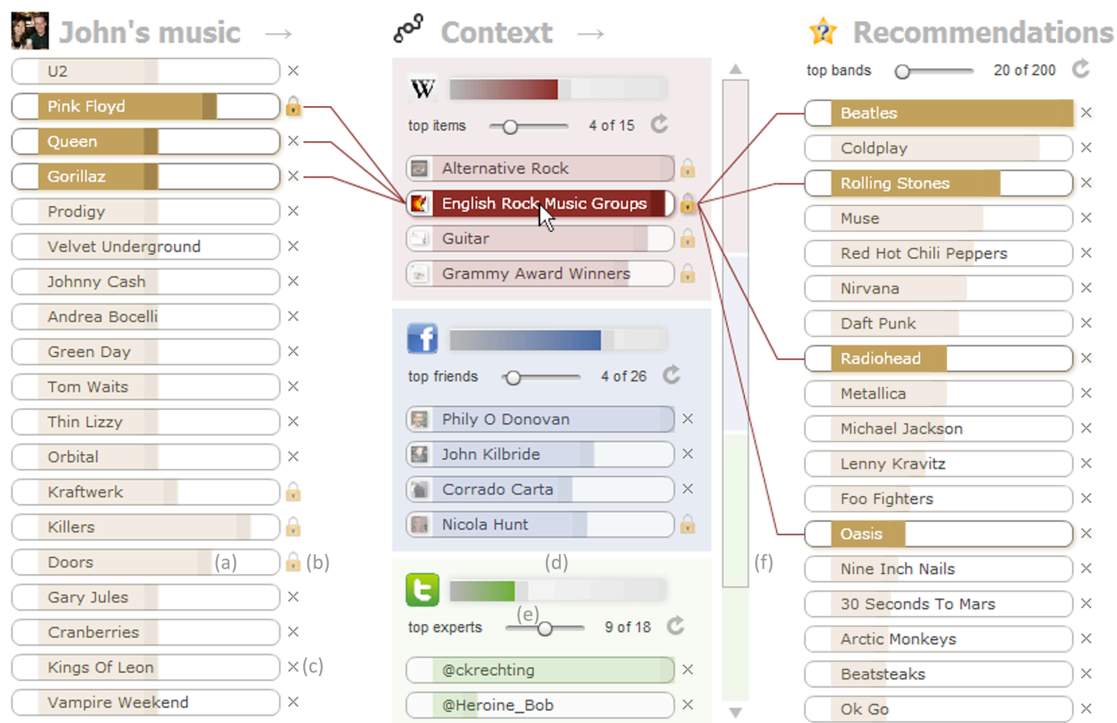
Challenges:

- ➔ Need for more dynamic, more adaptable algorithms that can cope with diverse data from APIs.
- ➔ And, we need an interface that can keep up…

Solutions?

User interfaces help to explain provenance of a recommendation. This can improve users' understanding of the underlying system and contribute to better user experience and greater satisfaction

Interaction allows users to: tweak otherwise hidden systems settings; provide updated preference data, recommendation feedback etc. etc.



TasteWeights: Background

Initial Work on Graph-based Representations of Collaborative Filtering Algorithms:

PeerChooser : Based on static MovieLens data

SmallWorlds: Web-based, dynamic data from Facebook API.

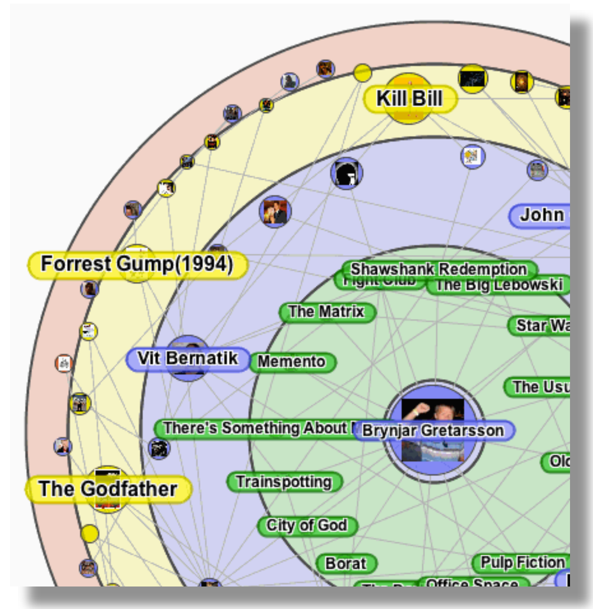
Issues discovered during evaluations:

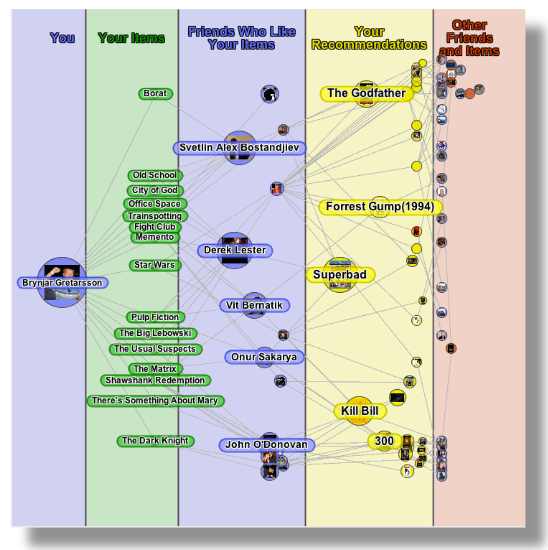
PeerChooser: Interaction with nodes that represent movie genres …too coarse.

SmallWorlds: A "complete" representation, but far too complicated view.

Learning from evaluations:

Abstraction, Detail-on-demand, Interactive Visual Cues, Cleaner game-like graphics, and more flexible API connectivity. Focus on "social" recommendation.





SmallWorlds

Interactive, Trust-based Recommendation for the Social Web

Live at http://apps.facebook.com/smallworlds

Interactive, Trust-based Recommender for Facebook Data

Supports user interaction to update information at recommendation time

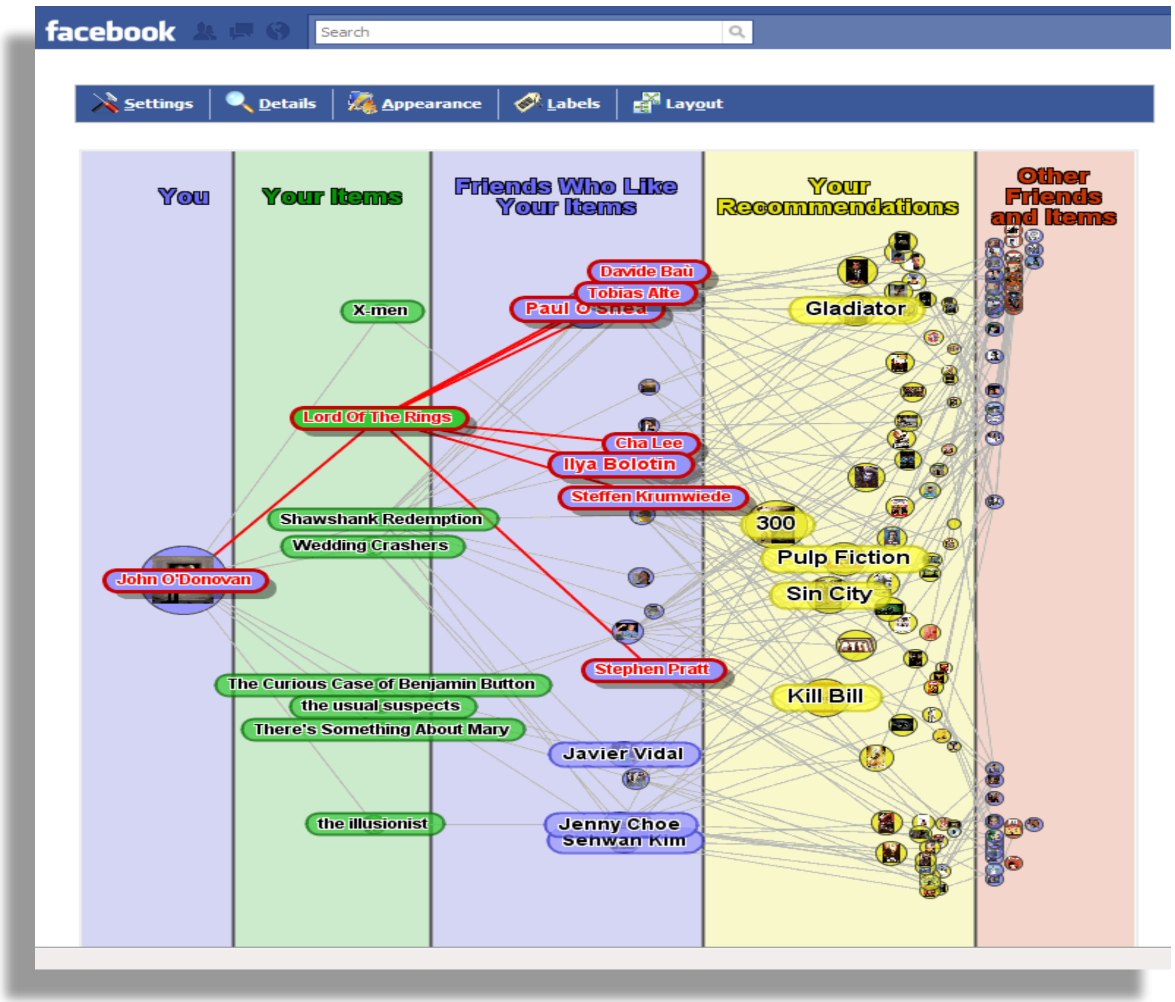
>Solves stale data problem.

Makes the ACF algorithm transparent and understandable.

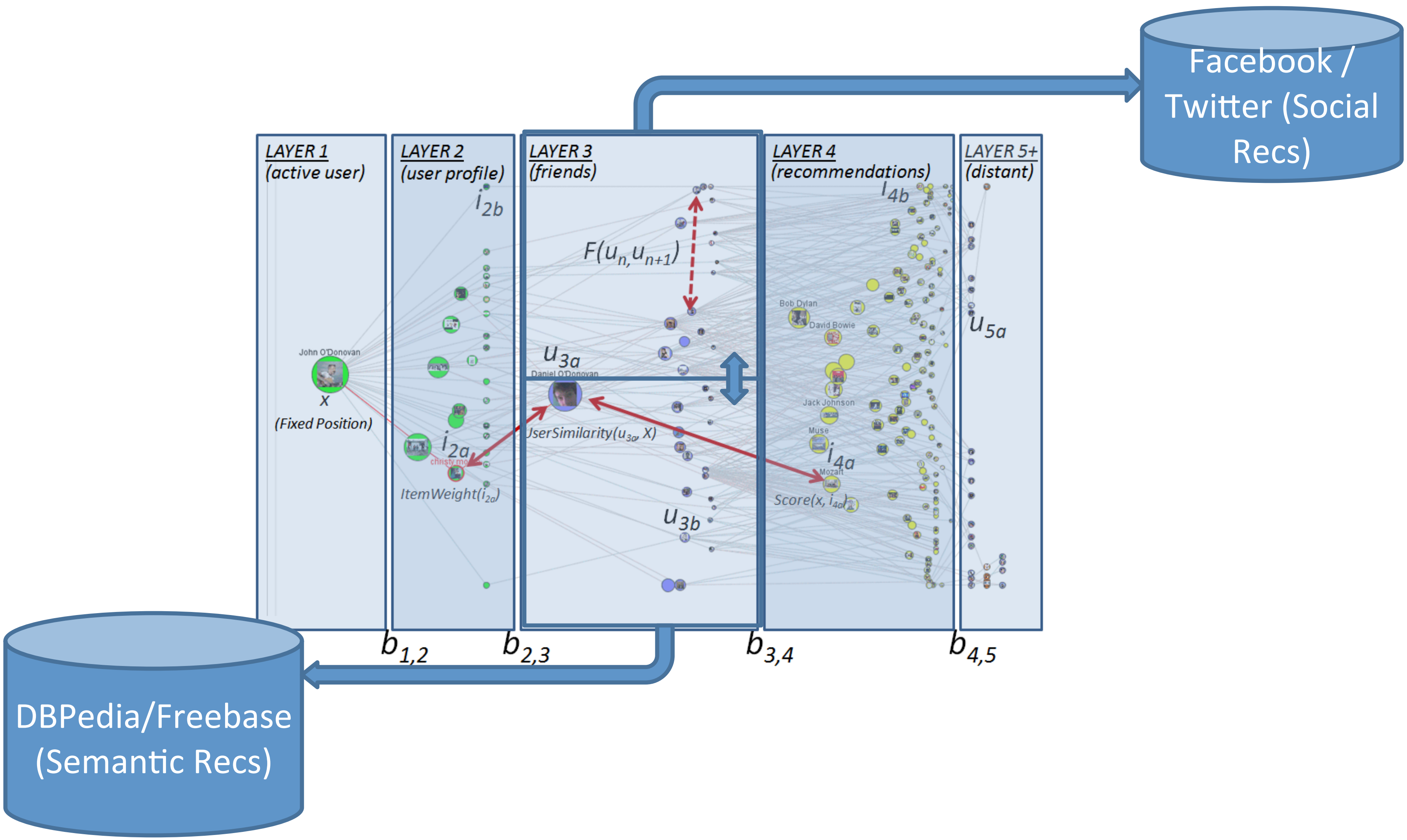
>increases satisfaction, acceptance etc.

Enables fast visual exploration of the data

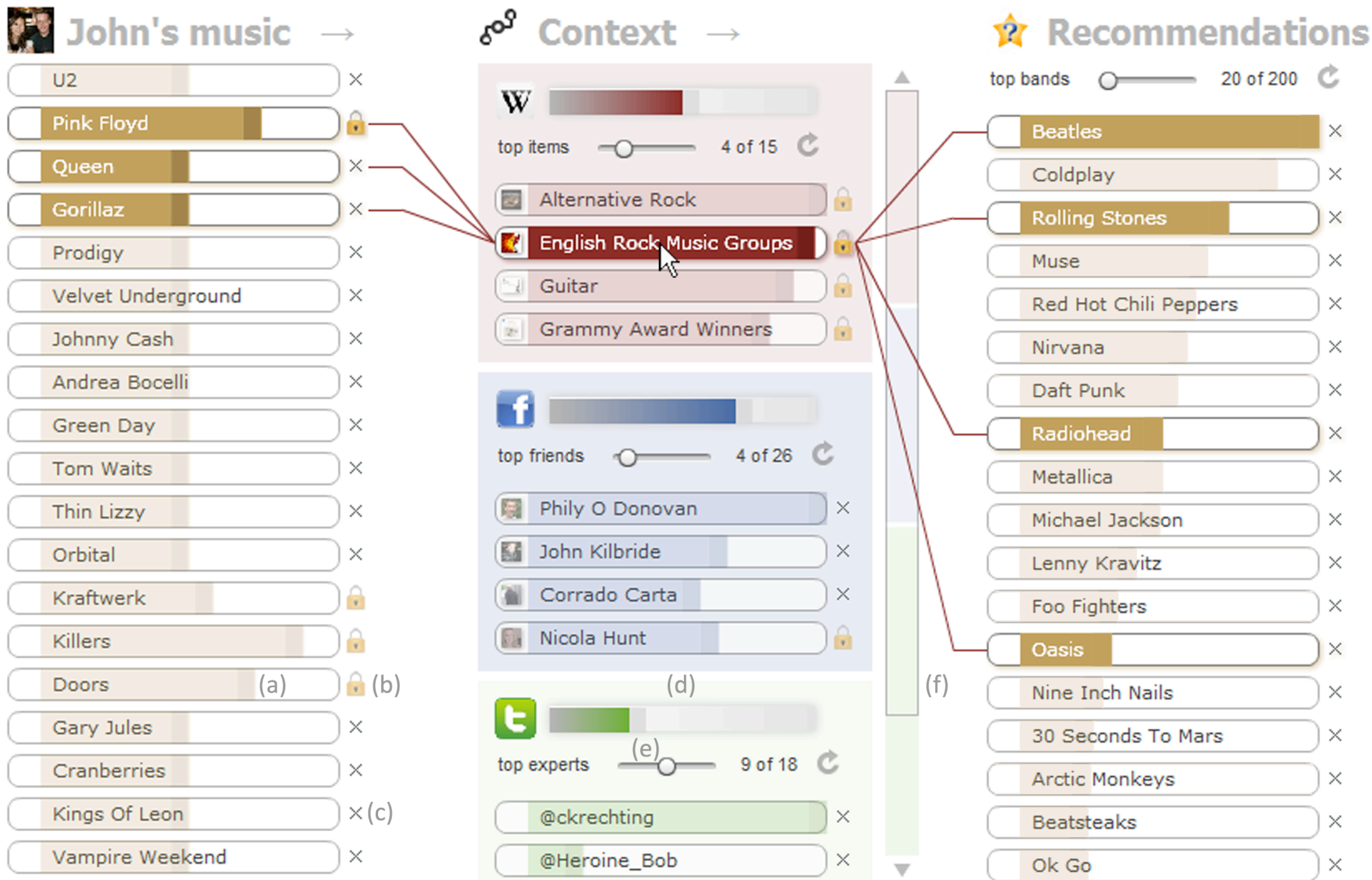
>what-if scenarios
>increases learning



Combining Social and Semantic Recommendations



TasteWeights Design

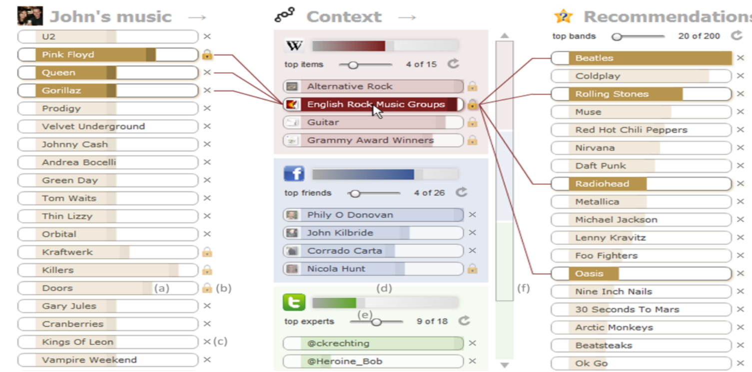


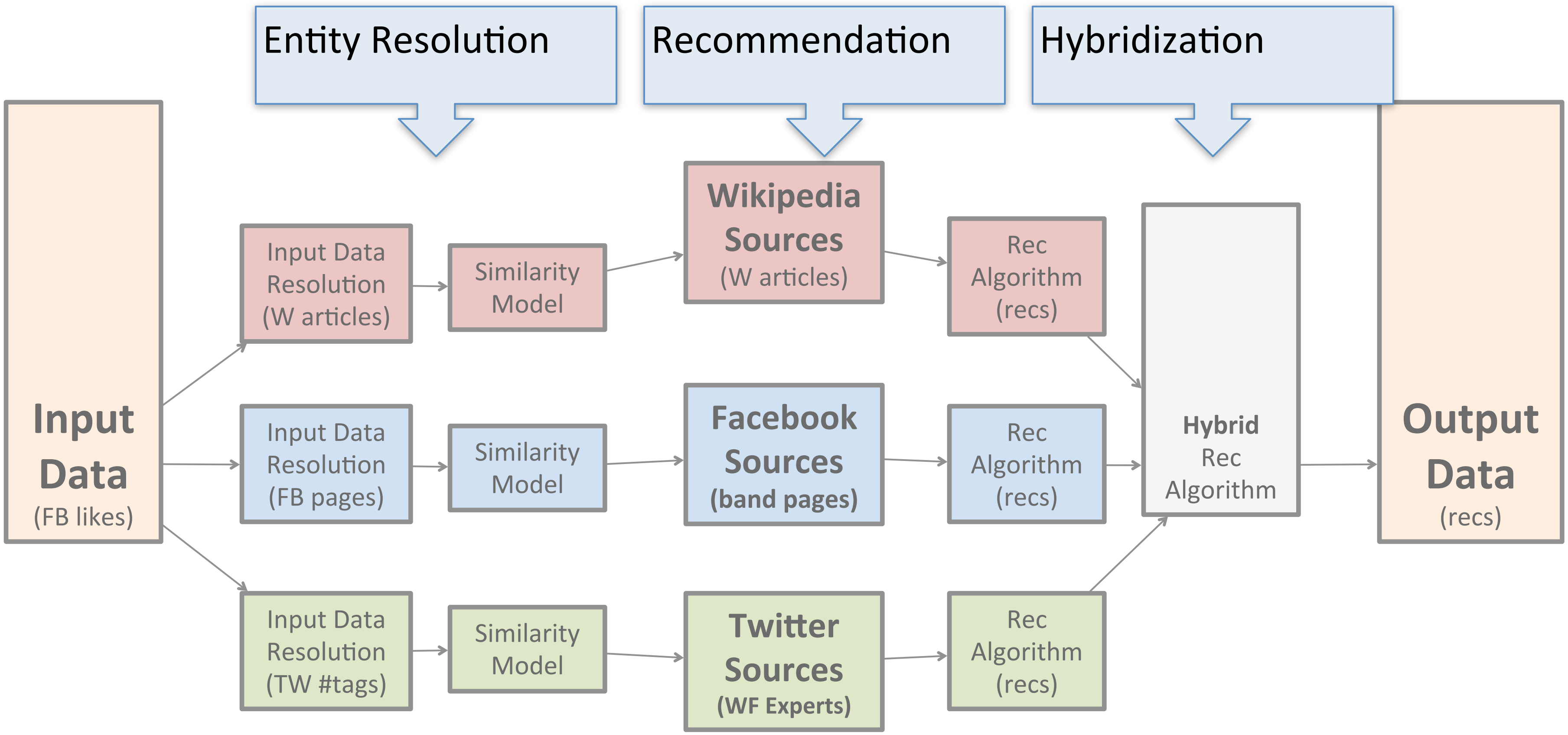
Demo

http://www.youtube.com/watch?v=9_JgynePm9w&hd=1

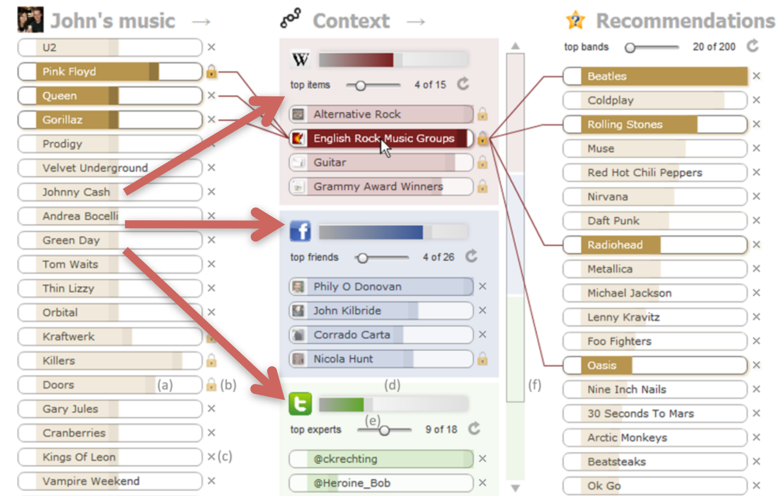
Approach

Parallel hybrid recommender system





Recommendation Sources



Input Data Resolution

Mapping between Wikipedia articles

Facebook pages, and Twitter #tags

Similarity Models

Wikipedia

(Data source: DBpedia)

$$W_{wiki_i} = \sum_{Linked(profile_j, wiki_i)} W_{profile_j}$$

Facebook

(Data source: Facebook Graph API)

$$W_{friend_i} = \frac{TWCI_{user, friend_i}}{\sqrt{TWI_{user}^2 \cdot TWI_{friend_i}^2}}$$

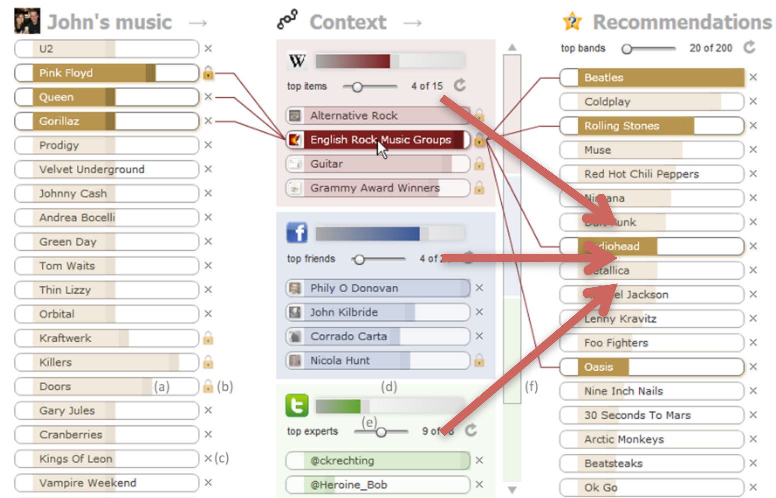
Twitter

(Data source: wefollow.com)

$$S_{expert_i, item_j} = \frac{|Experts_{item_j}| - Rank_{expert_i, item_j}}{|Experts_{item_j}|}$$

$$W_{expert_i} = \sum_{Linked(profile_i, expert_i)} (W_{profile_j} \cdot S_{expert_i, profile_j})$$

Generating Recs.



Individual Source

$$W_{rec_i,source_j} = \sum_{Linked(rec_i,item_k)} W_{item_k}$$

Hybrid Strategies

Weighted

$$W_{rec_i} = \sum_{source_j \in sources} (W_{rec_i,source_j} \cdot W_{source_j})$$

Mixed

Cross-source

$$W_{rec_i} = \sum_{source_j \in sources} (W_{rec_i,source_j} \cdot W_{source_j}) \cdot |Sources_{rec_i}|$$

Evaluation

Goals

Evaluate combining social and semantic recommendations

Evaluate explanation and transparency in a hybrid recommender

Evaluate interaction in a hybrid recommender

Setup

Supervised user study. 32 participants from the human subject pool at UCSB

Procedure

Pre-questionnaire

Tasks

- *Interact with Profile*
- *Interact with Sources*
- *Interact with Full interface*
- *Rate recommendations*

Post-questionnaire (Explanation & Interaction)

Evaluation: Accuracy

Experiment

One-way repeated measures ANOVA

Compared 9 recommendation methods (below) in terms of rec. accuracy

Method (independent variable)

Single-source: Wikipedia, Facebook, Twitter

Hybrid: Weighted, Mixed, Cross-source

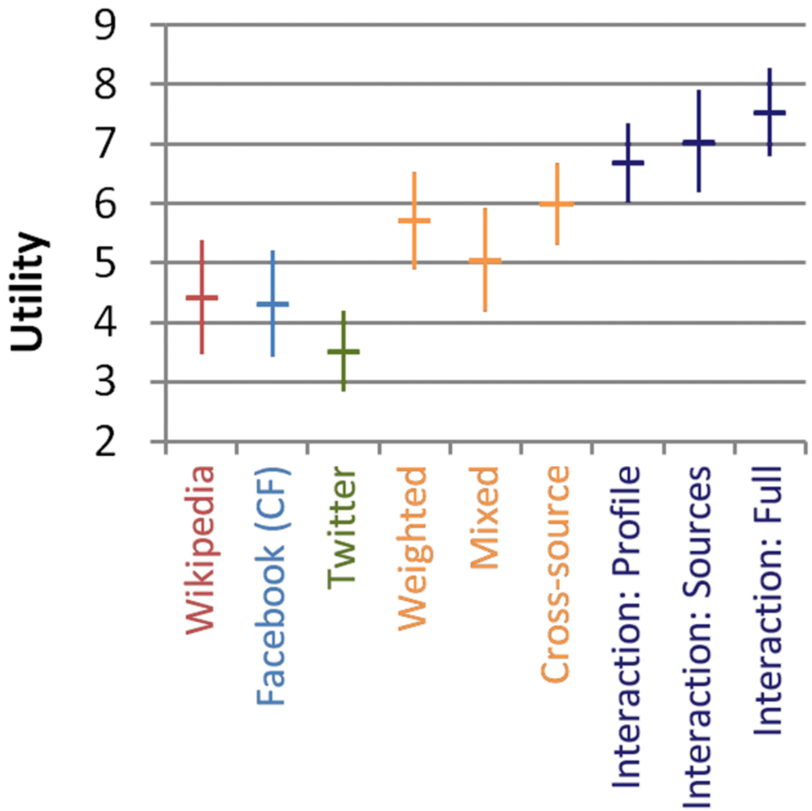
Interaction: Profile, Sources, Full

Accuracy (dependent variable)

Measured in terms of "**Utility**"

$$R_u = \sum_j \frac{max(r_{ui_j} - d, 0)}{2^{\frac{j-1}{\alpha-1}}}$$

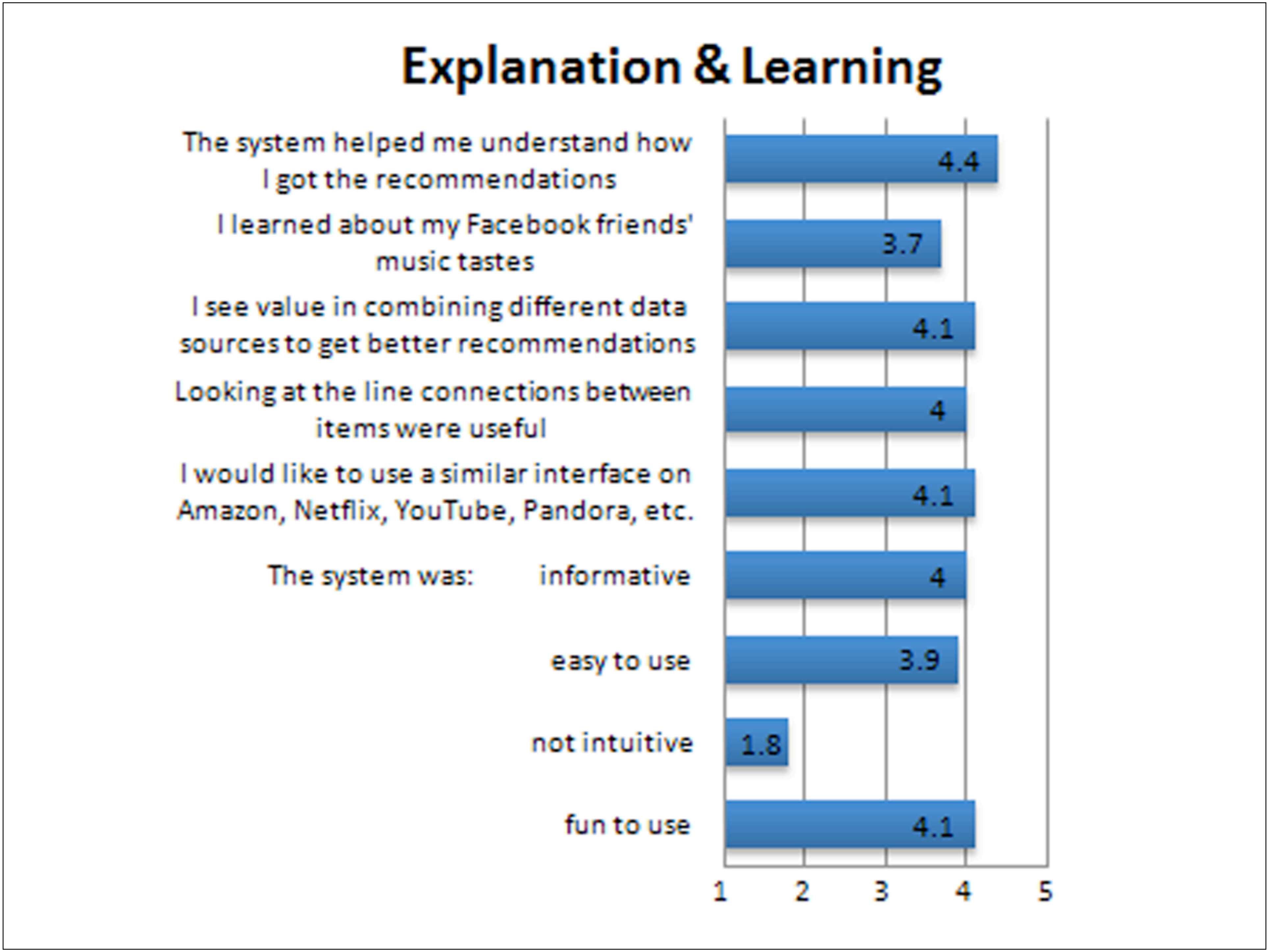
Results: Accuracy

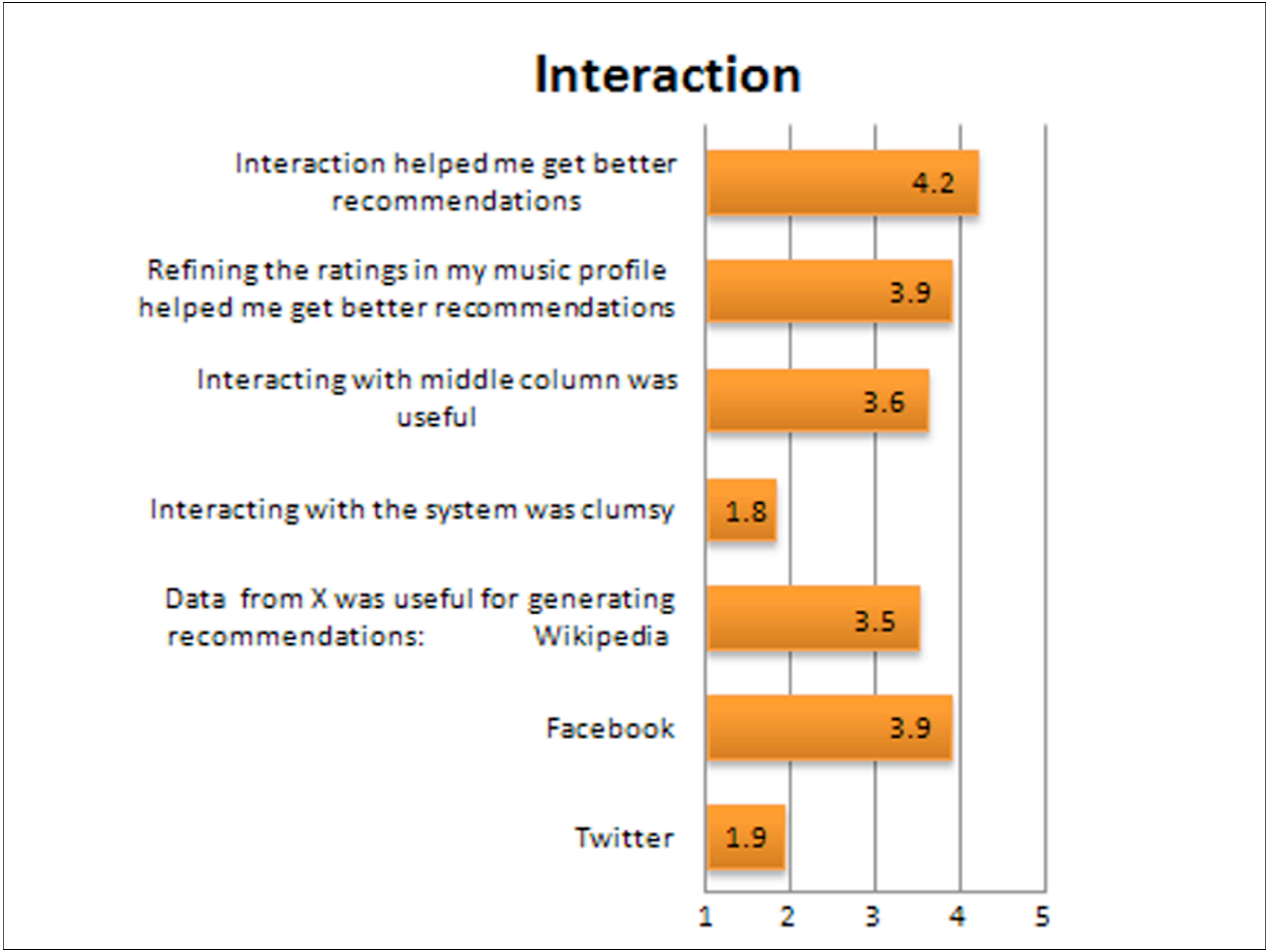


Plot of means of recommendation methods over utility with 95% confidence intervals

Method 1	Method 2	Diff	Lower	Upper	P Val
Cross Hybrid	Wikipedia	1.568	0.119	3.017	0.023
Cross Hybrid	Facebook (CF)	1.678	0.229	3.127	0.011
Cross Hybrid	Twitter	2.477	1.028	3.926	0.000
Full Interaction	Cross Hybrid	1.542	0.935	2.991	0.027

Results from a Tukey post-hoc analysis of the recommendation methods: multiple comparisons of means with 95% family-wise confidence level


Explanation & Learning
The system helped me understand how I got the recommendations
4.4
I learned about my Facebook friends' music tastes
3.7
I see value in combining different data sources to get better recommendations
4.1
Looking at the line connections between items were useful
4
I would like to use a similar interface on Amazon, Netflix, YouTube, Pandora, etc.
4.1
The system was:
informative
4
easy to use
3.9
not intuitive
1.8
fun to use
4.1
1
2
3
4
5


Interaction
Interaction helped me get better recommendations
Refining the ratings in my music profile helped me get better recommendations
Interacting with middle column was useful
Interacting with the system was clumsy
Data from X was useful for generating recommendations: Wikipedia
Facebook
Twitter
4.2
3.9
3.6
1.8
3.5
3.9
1.9
1
2
3
4
5

Results: Diversity

TasteWeights on LinkedIn Data

Case Study: Portability of TW interface

-Developed a Social-Semantic Recommendation algorithm for data from LinkedIn API
-Personalized for one "active" logged-in user.
-Visualized the algorithm in TasteWeights interface

Algorithm:

-Map profile items to noun-phrases
-Resolve to Wikipedia articles
-e.g.: ph.D => PHD, UCSB => UC Santa Barbara
-Compute similarity based on overlap in resolved entities.

Features

-Segmented / Organized user profile
-Interactive profile weighting
-Interactive weighting of social connections
-Dynamic re-ranking of recommendations (visual feedback)
-Provenance views to show effects of each interaction.

Conclusions

UI and interaction design are important considerations for RSs

-Increased explanation, provenance

-Expose otherwise hidden controls (e.g: control of hybrid recommender)

-Helps ease the stale data problem

-Support user input at various granularity (recommended item, recommendation partner, profile items etc)

-Increase ambient learning.

-Promote interest in the recommender system (game-like feel)

Contributions:

-Demonstrated a novel interactive RS

-Hybrid of recommendations from Wikipedia, Facebook and Twitter

-Evaluated via a 32 person supervised user study at UCSB.

-Demonstrated portability of the system on LinkedIn's API.

Results

-Interaction increases user satisfaction in all conditions. (more interaction = higher accuracy)

-Cross-source hybrid strategy outperformed individual source strategies.

After the break… Inspectability and

In this work we touched on the ideas of inspectability and control in the context of our hybrid recommender system.

In the next talk, Bart Knijnenburg (UC Irvine) will present results from a larger study that focuses on a general analysis of inspectability and control in social recommenders. This study used some components from our TasteWeights system.

Thanks for listening!