



# HCI for Recommender Systems

## The past, present and future

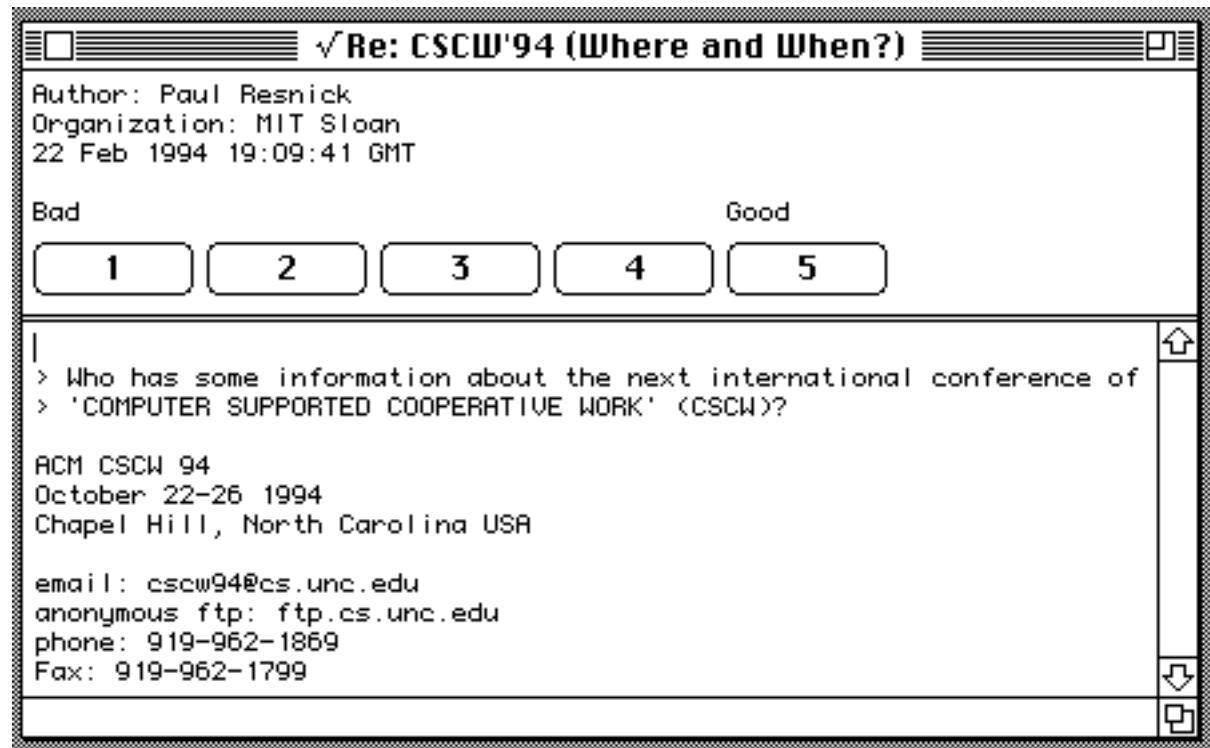
**André Calero Valdez, Martina Ziefle, Katrien Verbert**  
Human-Computer Interaction Center, RWTH-Aachen University  
KU Leuven, HCI-Group



# Recommenders have come a long way

## And so have their interfaces

- Examples
  - GroupLens
  - Entrée
  - TasteWeights
  - PeerChooser
  - TalkExplorer



Resnick et al. 1994

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Burke 2000

Figure 1: Entry point for the Entrée system

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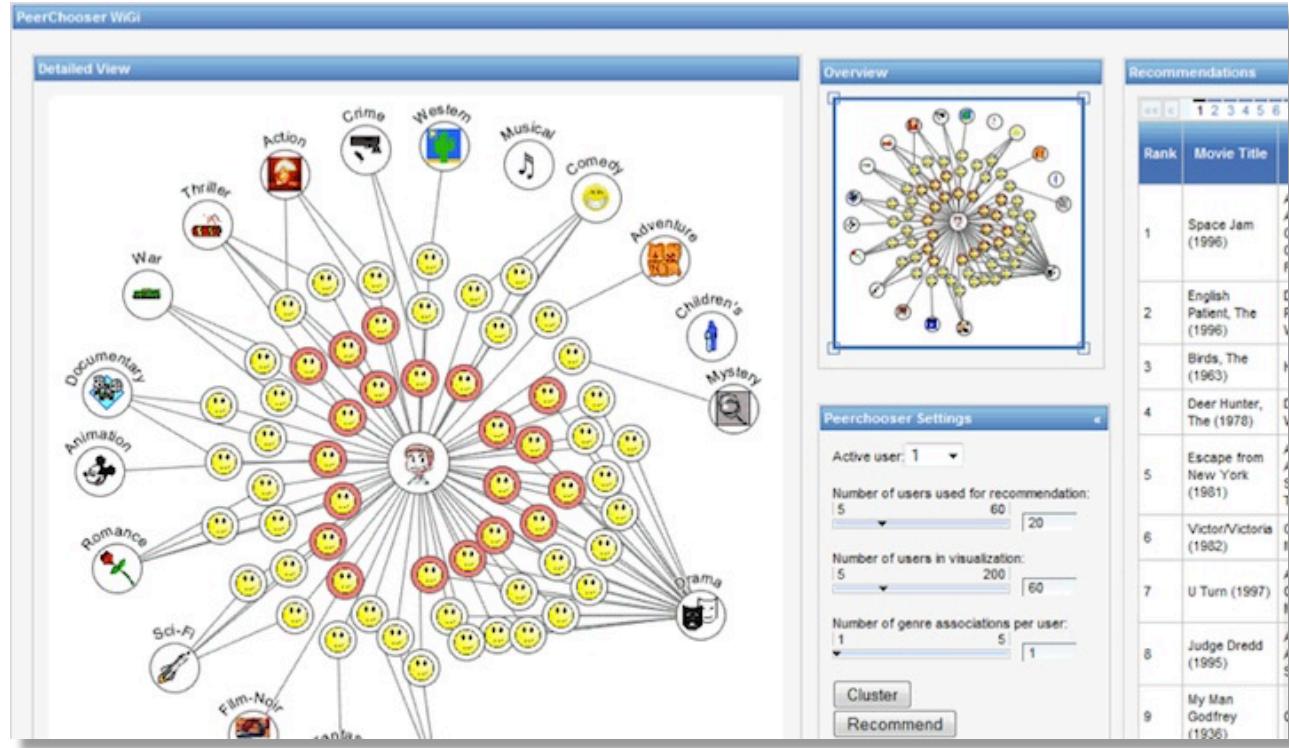


Bostandijev et al. 2012

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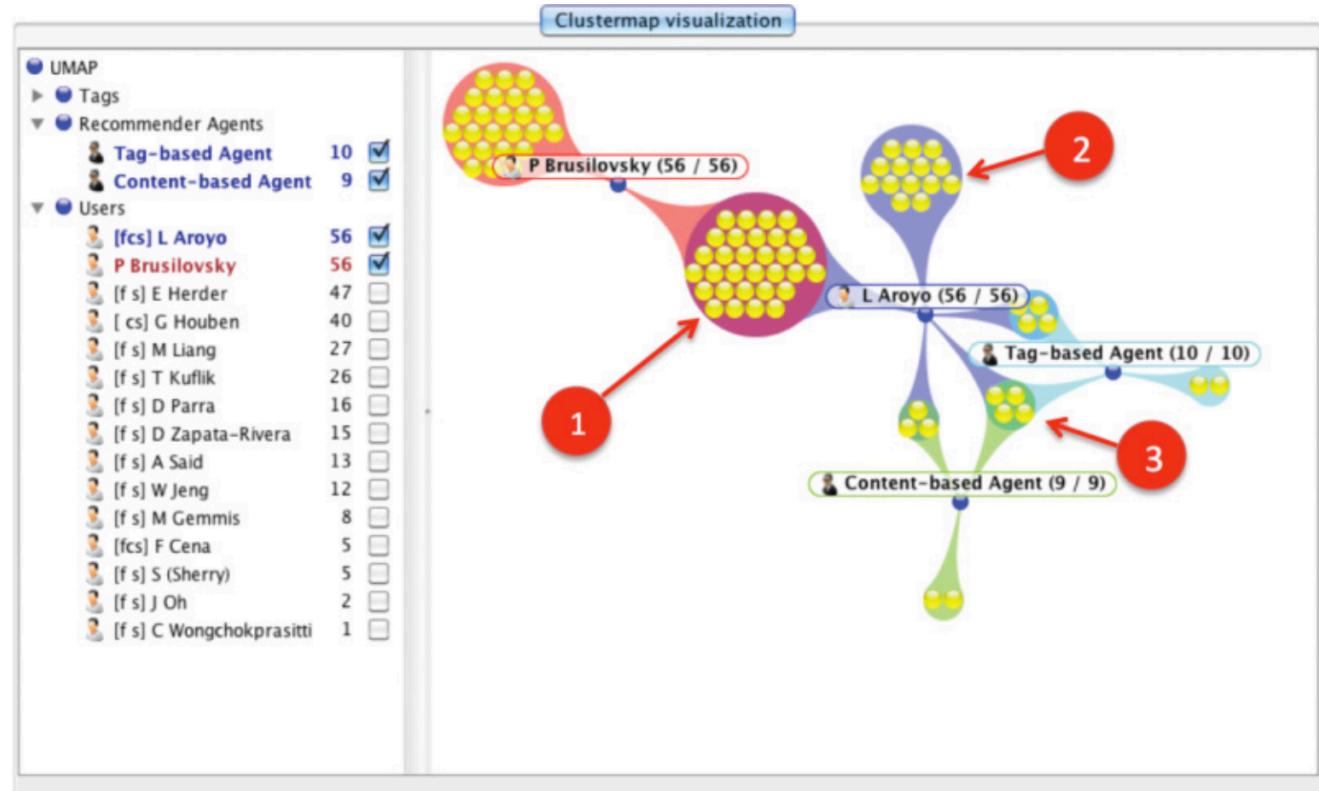


O'Donavan et al. 2008

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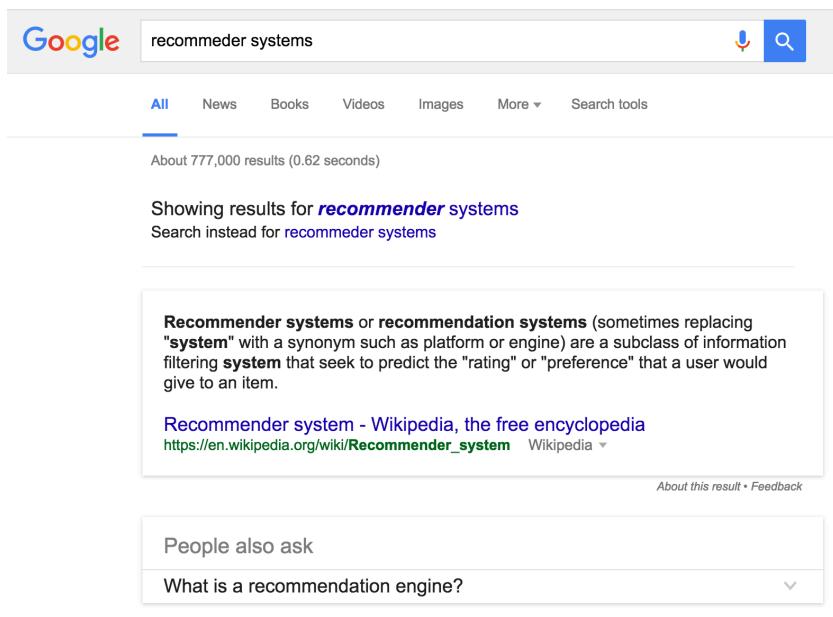


Verbert et al. 2014

# Recommender systems are everywhere

## Applications and domains

- E-Commerce, tourism, information retrieval, e-Learning, people recommendation, group recommendation, search, media and communications



A screenshot of a Google search results page for the query "recommender systems". The search bar shows the query. Below it, the "All" tab is selected, followed by News, Books, Videos, Images, More, and Search tools. The results section starts with a snippet about recommender systems, followed by a link to the Wikipedia article on Recommender system. A "People also ask" section at the bottom contains the question "What is a recommendation engine?".



A screenshot of an Amazon product page for an iPhone 6S. The main image shows two iPhone 6S phones, one silver and one black. Below the images, there's a section titled "Für größere Ansicht Maus über das Bild ziehen" (Move mouse over the image for a larger view). To the right, there's a sidebar with the heading "Kunden, die diesen Artikel gekauft haben, kauften auch" (Customers who bought this item also bought) and a list of recommended products:

- Bingsale Premium Bumper case iPhone 6S Schutzhülle hülle hardcase (transparent, iPhone 6S)  
EUR 6,27 Prime
- iPhone 6S Schutzglas, Bingsale Gehärtetem Glas Schutzfolie Displayschutzfolie...  
EUR 6,27 Prime
- Amazon Protect 1 Jahr Gerät- & Diebstahlschutz amazonprotect  
EUR 89,99
- Samsung Galaxy S7 Edge - Dual SIM 32GB Black - Elektronik  
EUR 89,99

# Accuracy

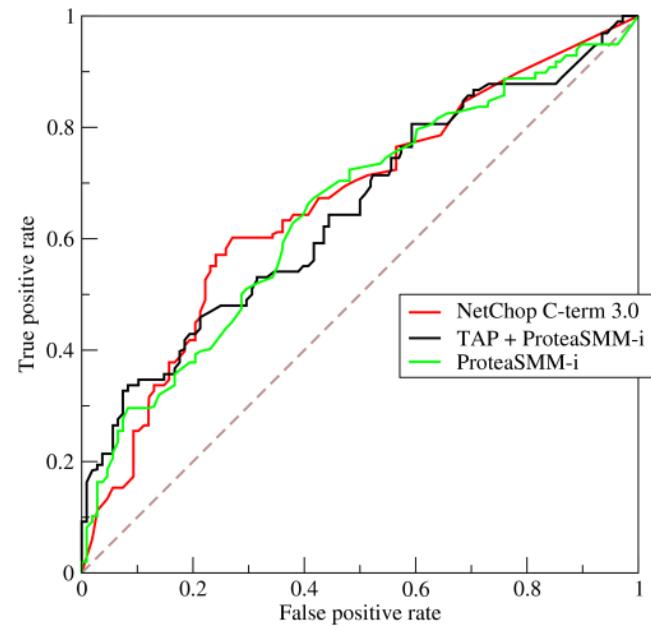
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## Early Research focused on accuracy

- (R)MSE, F-Measures, ROC, Signal-Detection Theory

=> Beyond Accuracy (McNee et al. 2006)

- User Control, Transparency
- User centered Evaluation frameworks (Pu et al. 2012)
- Transparency by interactive recommenders (He et al. 2016)

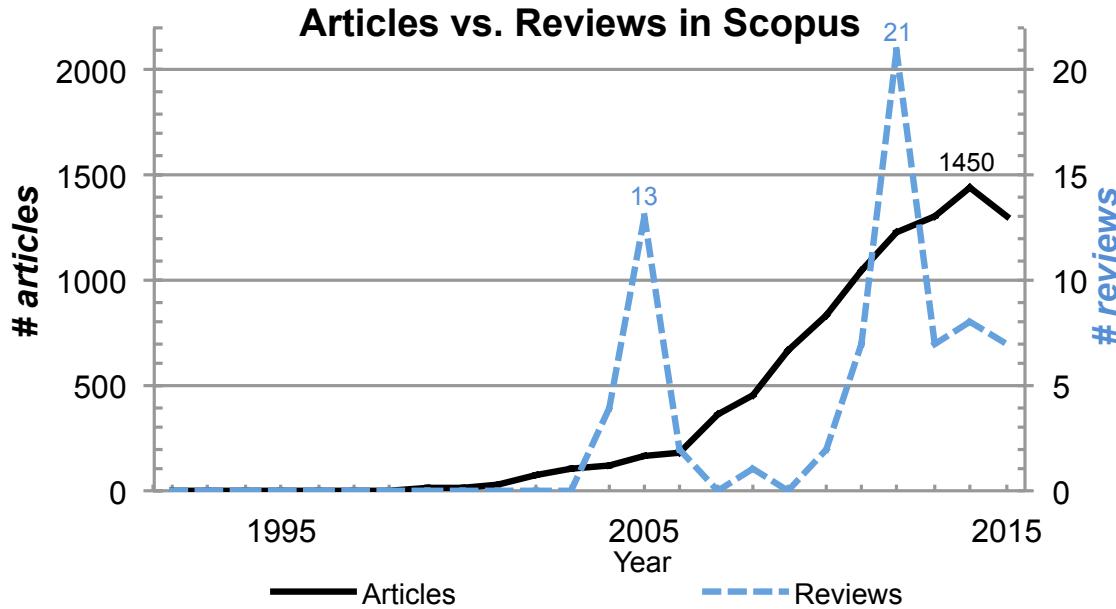


## But where are we going

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### Where is still work to do?

- Increasing interest in recommender systems
- Two surges in reviews



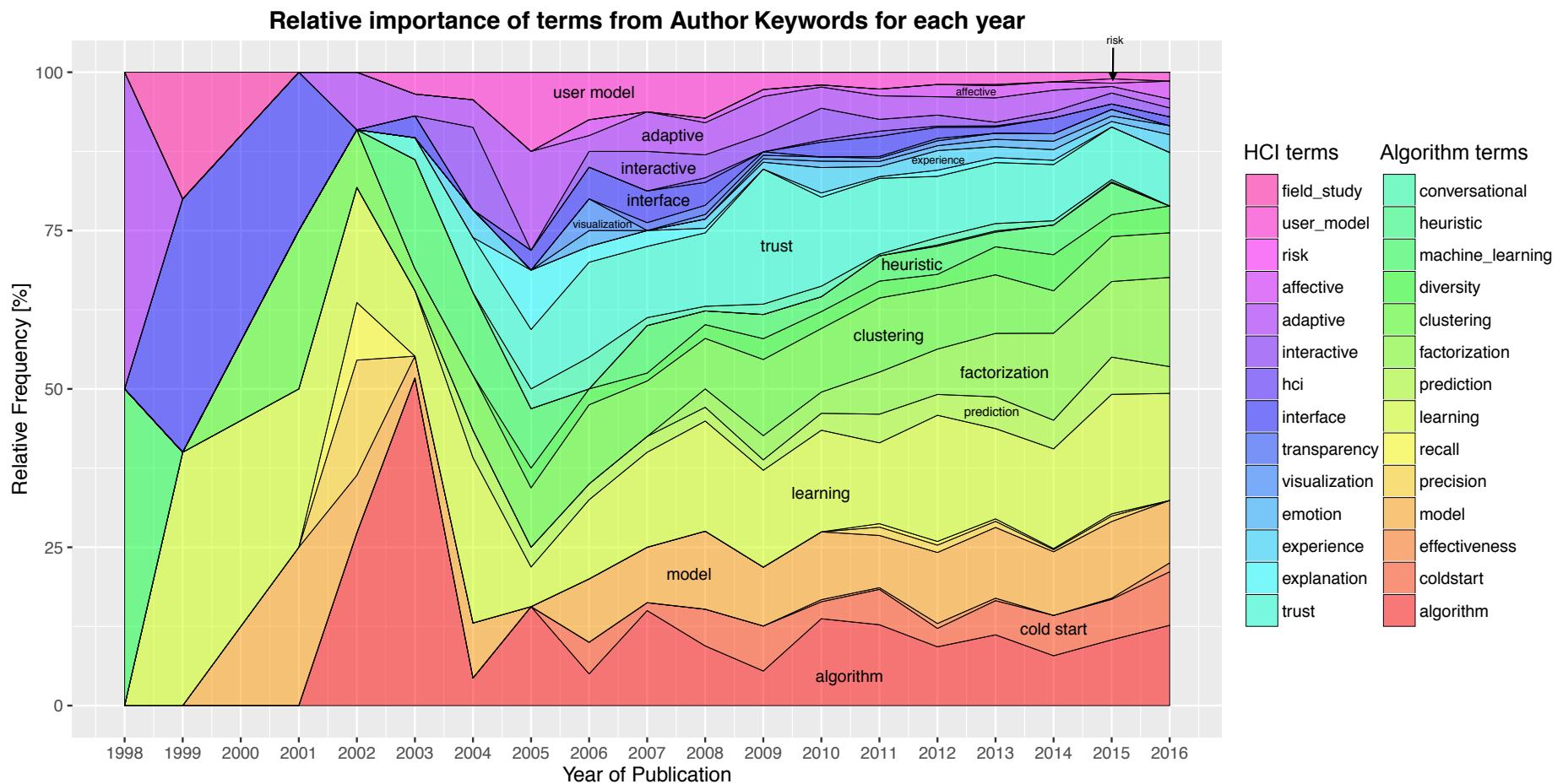
# How much research is done where?

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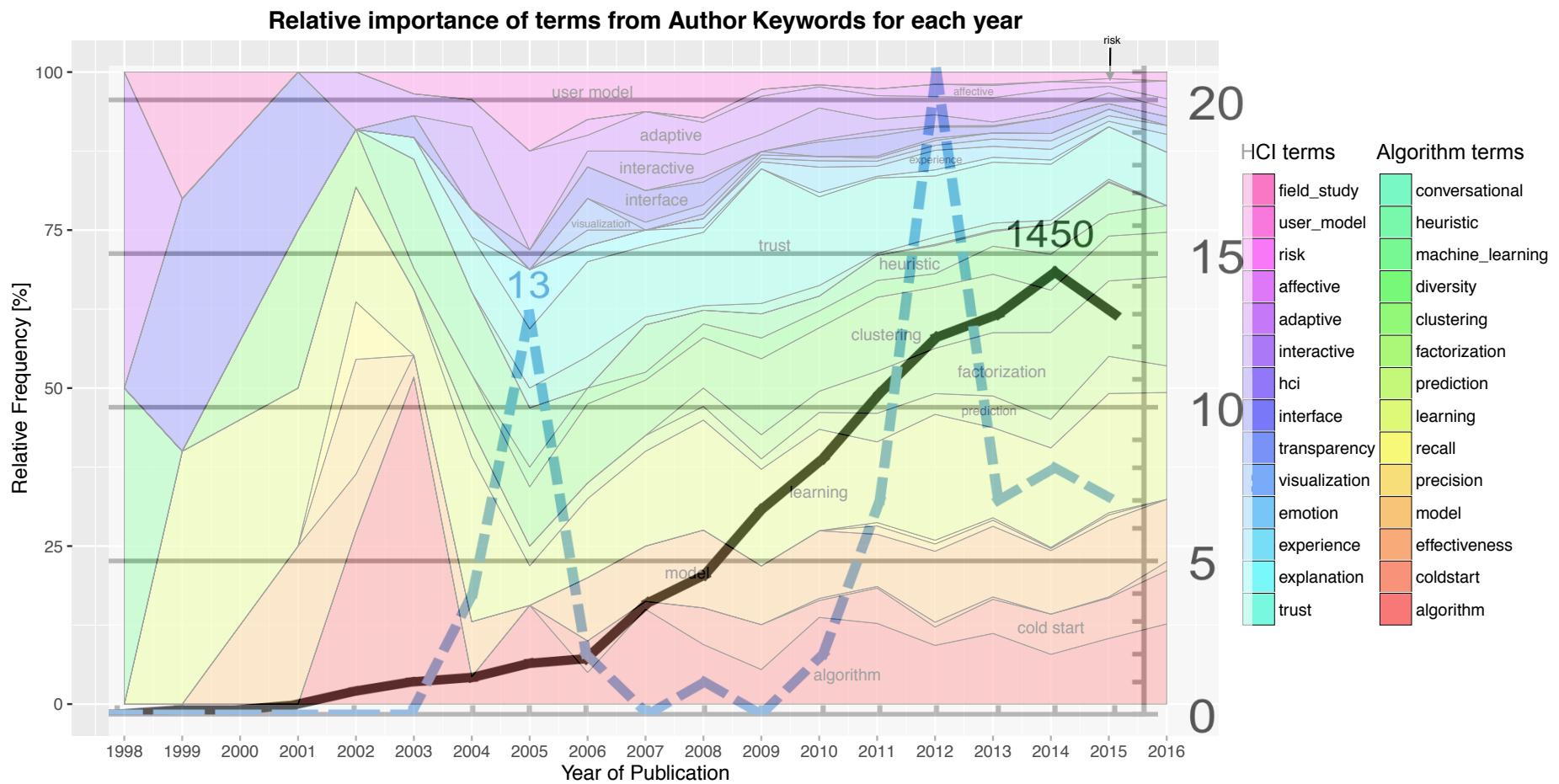
## Bibliometric analysis

- Downloaded all meta-data from scopus matching (recommend\* system\*) from CS
  - Does not find Tapestry (Geldberg et al. 1992, or Resnick & Varian 1997)
  - N=9,432 (April 10<sup>th</sup> 2016)
- Applied bag of words model (stop word deletion, stemmed, common phrases)
- Created a corpus for each year (1998 – 2016)
- Applied TF-IDF on the 18 corpora
- Manually filtered terms starting from the top (merging synonyms manually)
- Picked 10 HCI Terms and 10 Algorithm terms

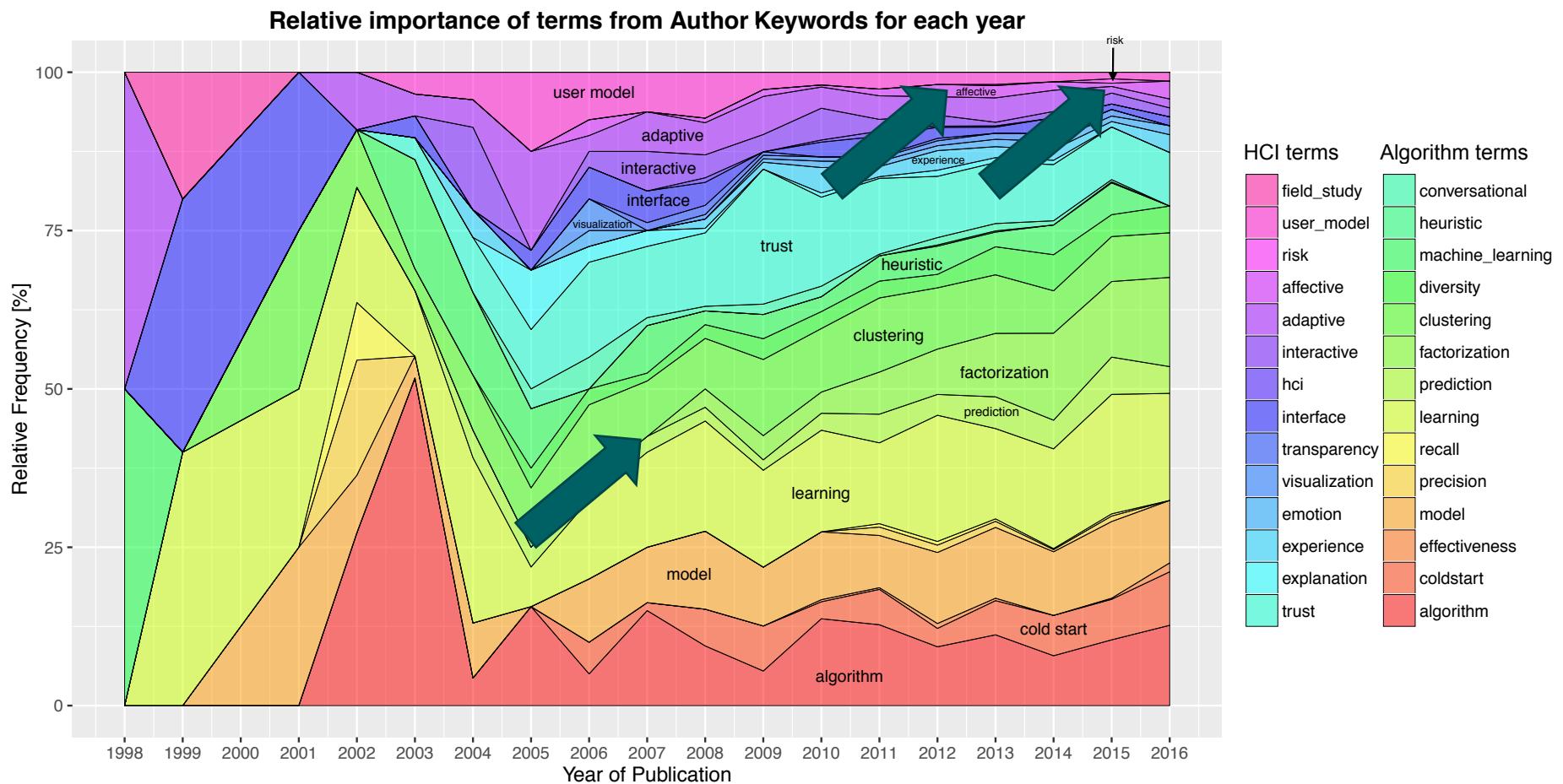
# Results



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# Conclusions

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## HCI for Recommender Systems

- Points of interest
  - 2005 Most cited review (Adomavicius & Tuzhilin, Herlocker et al.)
    - Topics: Adaptive Recommender Systems, User Model
  - 2009 Most cited review (Domingos et al., Konstan et al.)
    - Topics: Machine Learning, User Focus
- Can we use this insight as a recommendation?
  - Some HCI related topics are underrepresented
  - User Control (Adaptive Privacy, k-Anonymization, Insights from Visual Analytics, Parra & Brusilovsky 2016)
  - Adaptive to Human Factors (Knowledge, Expertise, Interests, Intent, Knijnenburg et al. 2011,)
  - Affective Computing (Novel implicit feedback, Hrabal 2013)
  - Uncertainty and high risk domains (Finance and Health, Naik et al. 2012)

## Future Challenges

- Big Data, Deep Learning, causal statistics, etc.
- New interaction paradigms (VR, AR, ambient interfaces)
- Analyzing interaction breeds new challenges
  - Privacy (Facial expressions, health status, etc.)
  - Data security
  - Robustness
- Participatory designed privacy trade-offs
- Cultural effects, ethical implications, etc.
- ...

# Thank you very much for your attention!

## Summary

- Recommender Systems needs HCI
- Bibliometric analysis of reviews and articles
  - Year based analysis of keywords
  - HCI and Algorithm terms
- Underrepresented Topics
  - User Control
  - Adaptive Interface
  - Affective Computing
  - Risk

