

Bartering Books to Beers:

a Recommender System for Exchange Platforms

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What is barter?

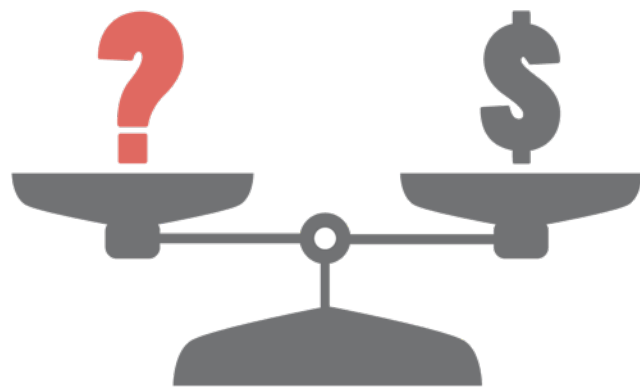
Def. Barter is a system of exchange where goods or services are directly exchanged for other goods or services without using a medium of exchange.



First written mention of barter
around 100'000 B.C

It's hard to compete with money

Need of a double coincidence



No common measure of value

No common measure of value

Solution: Online bartering platforms are **specialized**



20'000 daily visitors



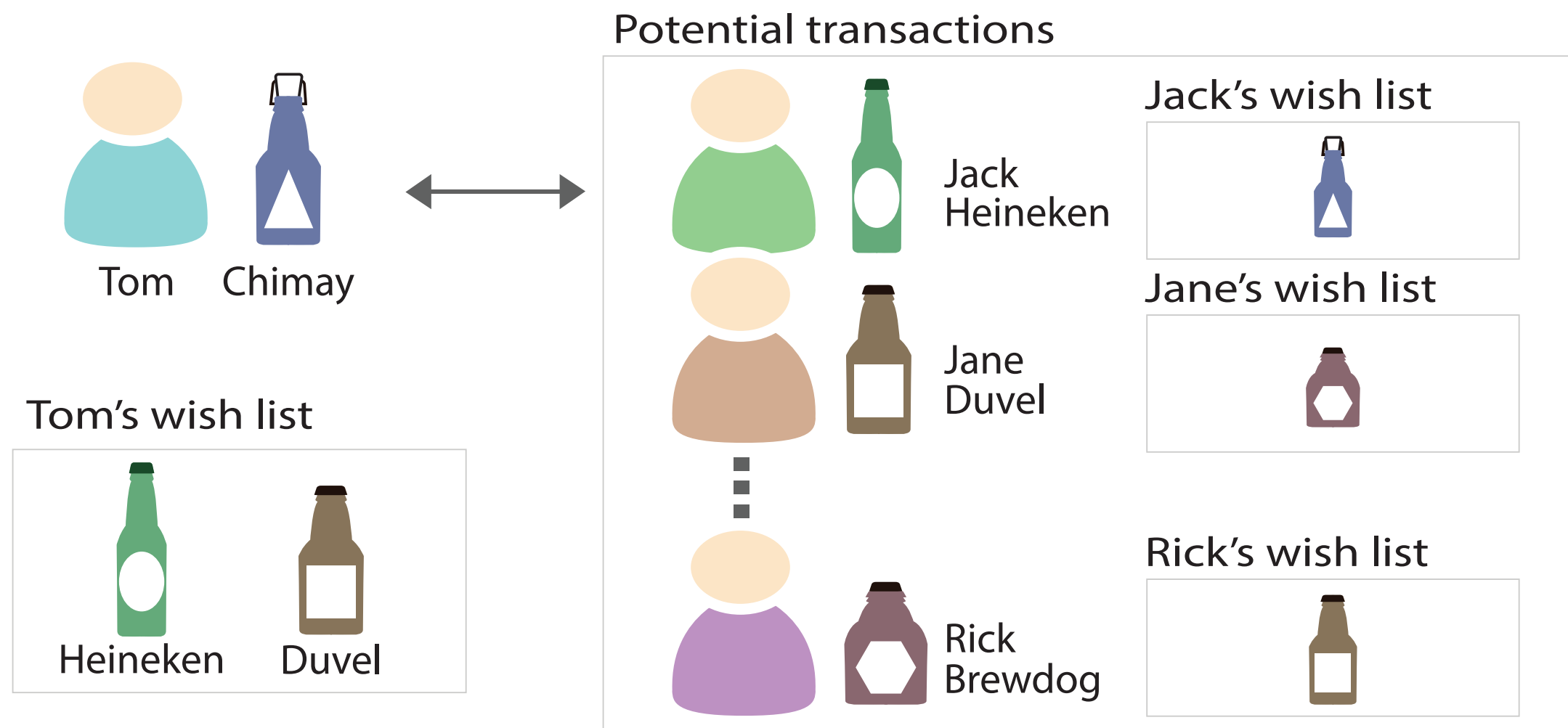
250'000 registered users



18'000 registered users

Double coincidence of wants

Typical setting



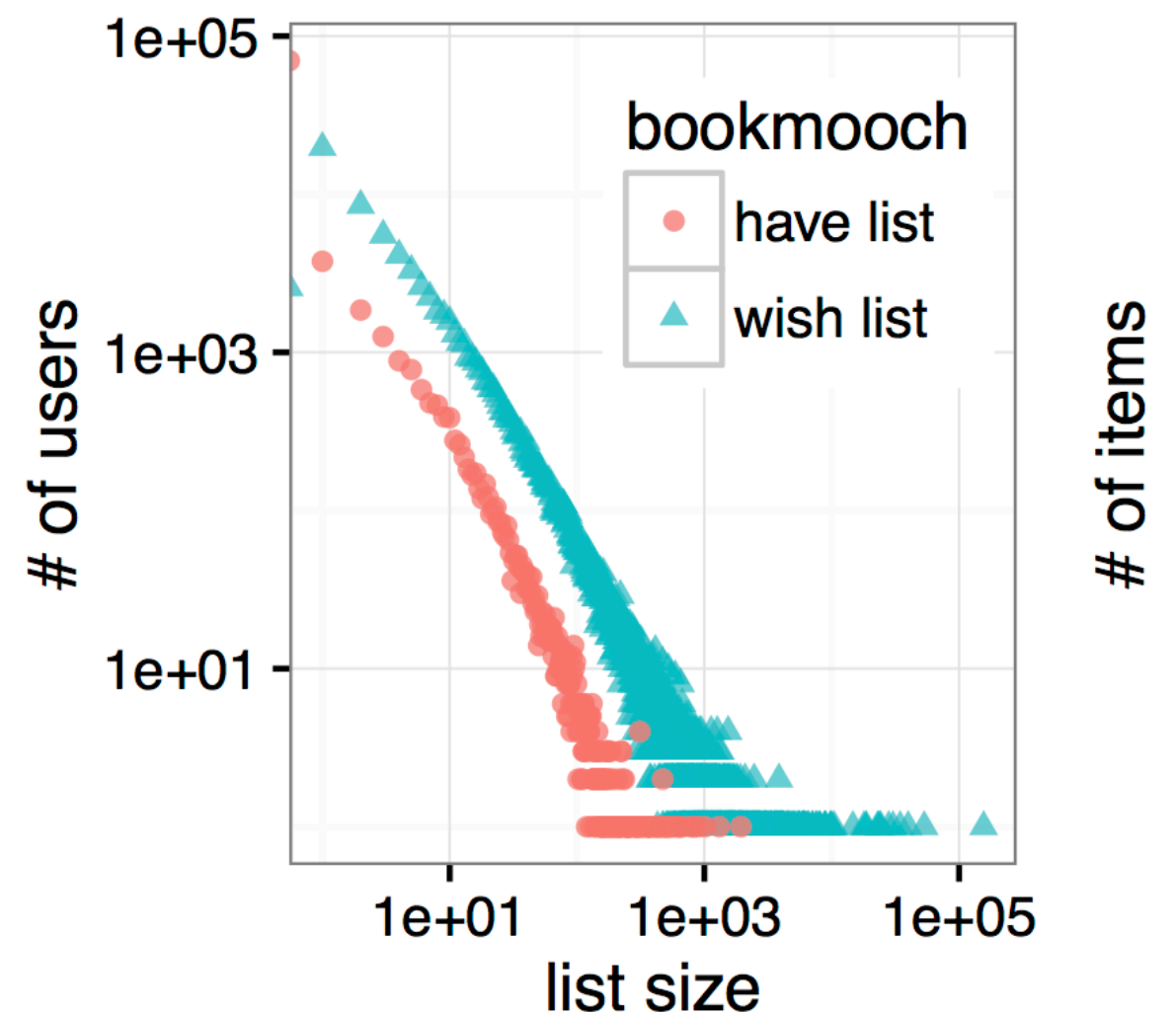
Double coincidence of wants

Solution: Matching?



85K active users

2M items



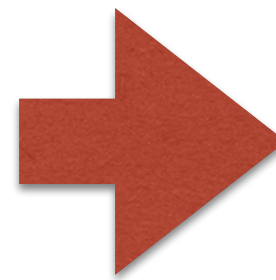
Double coincidence of wants

Solution: Matching?



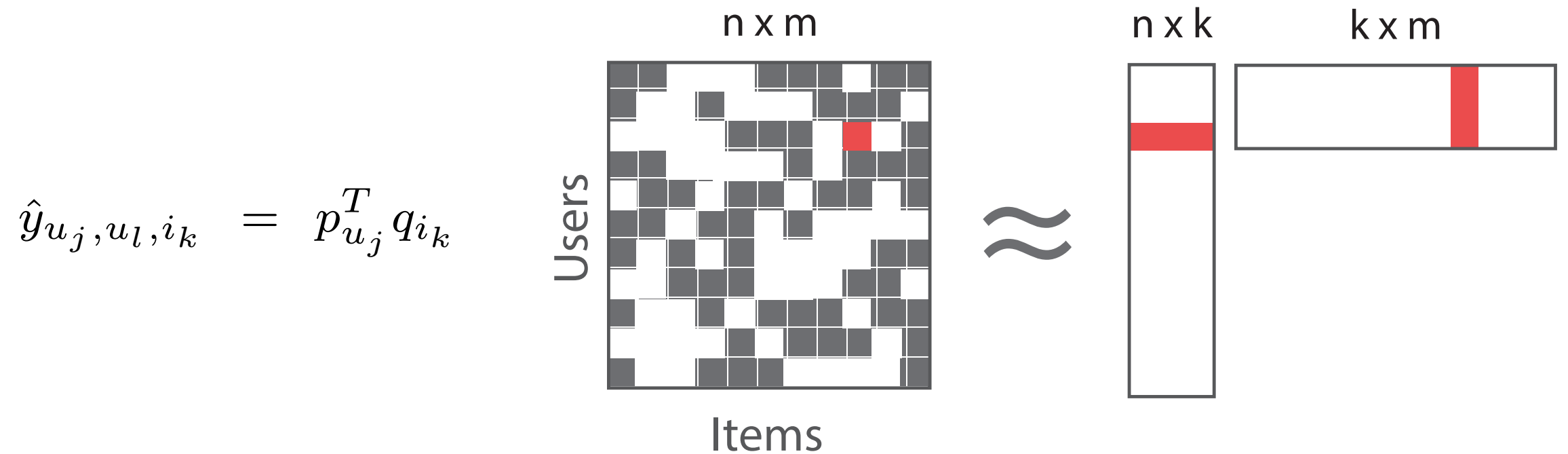
85K active users

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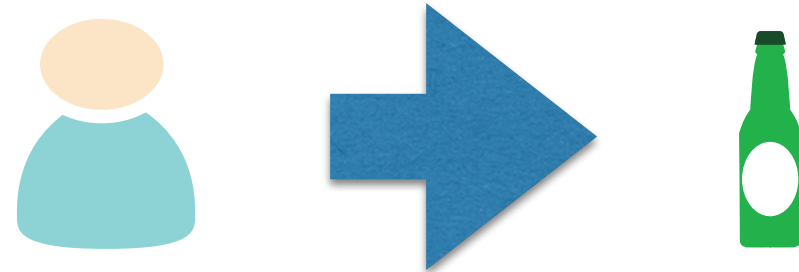


only 0.2% of users
have at least one
swapping partner

Predictor - Matrix Factorization



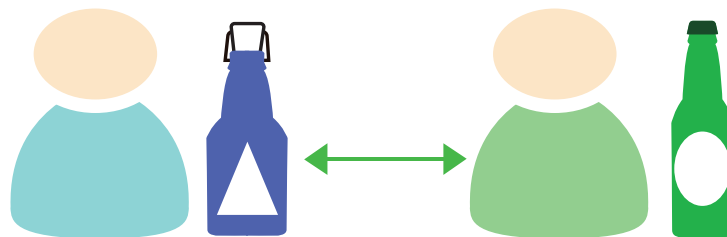
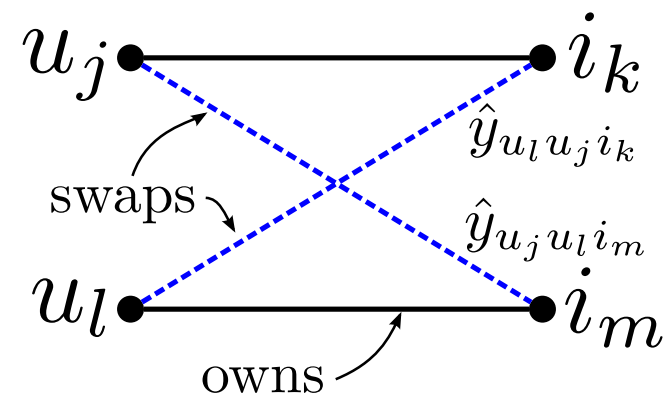
Unidirectional interest



Positive signals: wish-list + past transactions

Predictor - Bidirectionality

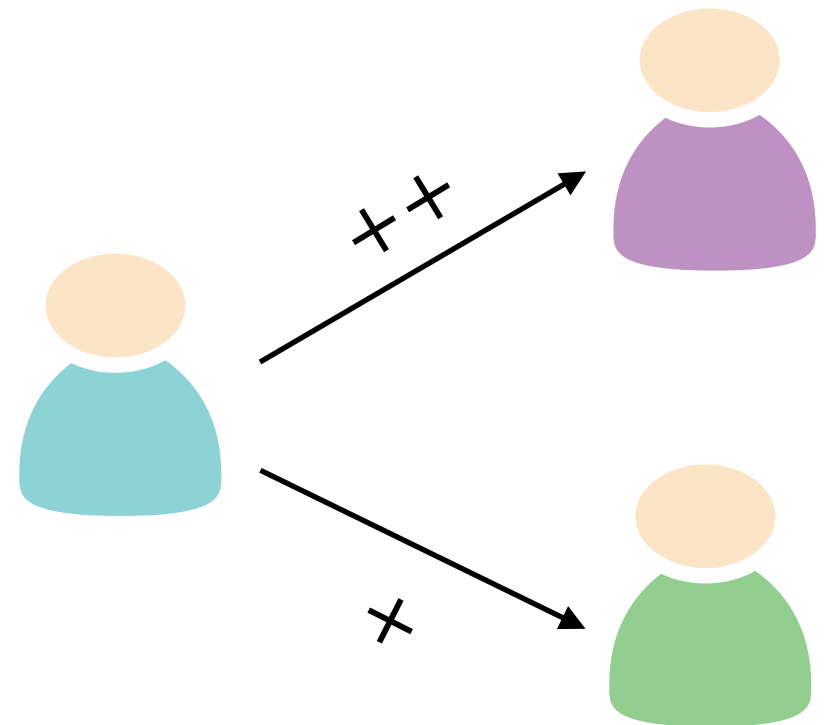
$$\begin{aligned}\hat{y}_{u_j, i_m, u_l, i_k} &= f(\hat{y}_{u_j u_l i_m}, \hat{y}_{u_l u_j i_k}) \\ &= \frac{1}{2}(\hat{y}_{u_j u_l i_m} + \hat{y}_{u_l u_j i_k})\end{aligned}$$



Make recommendations for one user but
take into account **reciprocal interest**

Predictor - Social Bias

$$\hat{y}_{u_j, u_l, i_k} = p_{u_j}^T q_{i_k} + \overbrace{s_{u_j u_l}}^{\text{social bias}}$$



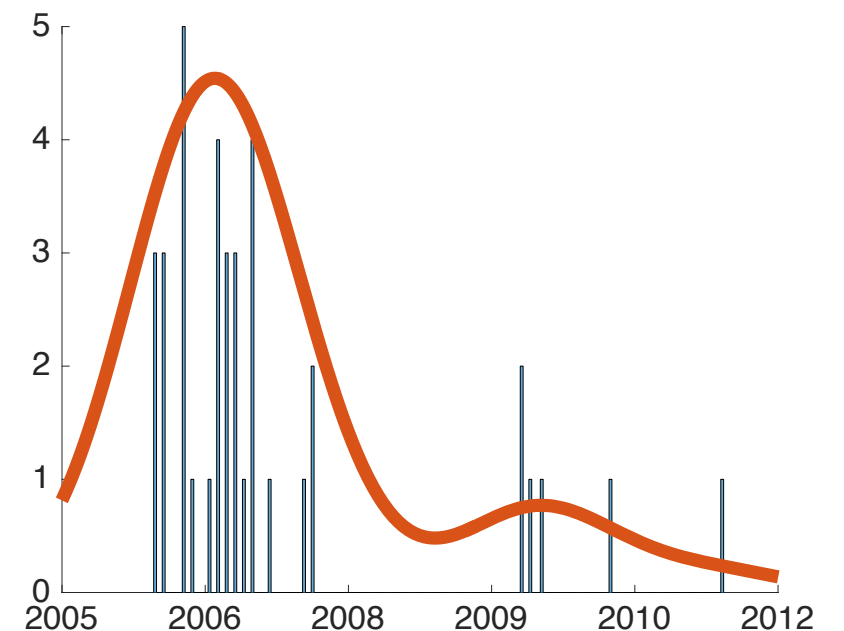
Some pairs of users perform **recurring trades**.

$S \in \mathbb{R}^{|U| \times |U|}$ models a bias from one user to another.

Predictor - Temporal Dynamics

$$\hat{y}_{u_j, u_l, i_k} = p_{u_j}^T q_{i_k} + \overbrace{s_{u_j u_l}}^{\text{social bias}} + \underbrace{\tau_{u_j} \delta(t; \bar{t}_{u_j}) + \tau_{i_k} \delta(t; \bar{t}_{i_k})}_{\text{temporal dynamics}}$$

Discard users/items that have been **inactive** for a long period

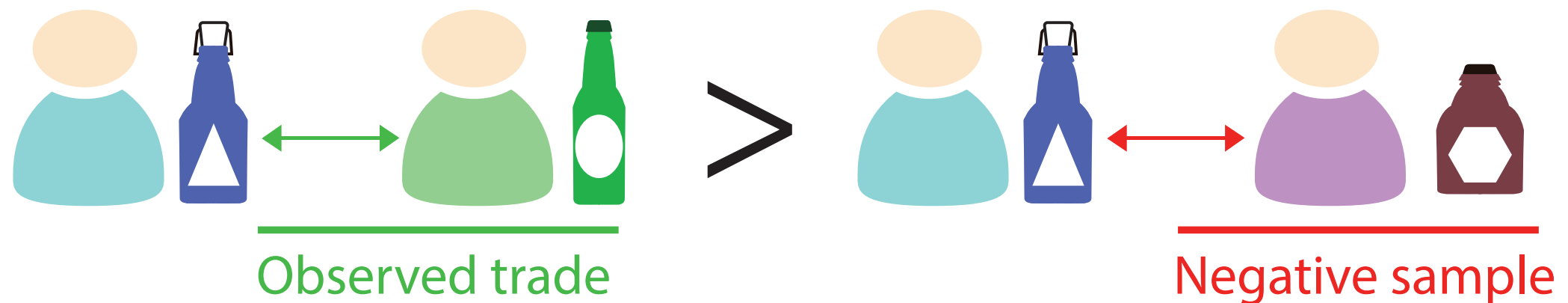


Experiment

Bayesian Personalized Ranking (BPR)

see Rendle 2009

Optimize AUC with positive examples only



Results

B

Bidirectionality

S

Social bias

T

Temporal dynamics

AUC

	MF	MF+B	MF+B+S	MF+B+T	MF+ALL
Bookmooch	0.758	0.798	0.849	0.938	0.958
Gameswap	0.790	0.842	0.863	0.890	0.903
Ratebeer	0.824	0.892	0.962	0.969	0.983

Contribution & Conclusion

- Reciprocal interest model for bartering recommendation.
- 3 new datasets extracted from online bartering platforms.
- Improving recommendations with social and temporal information.