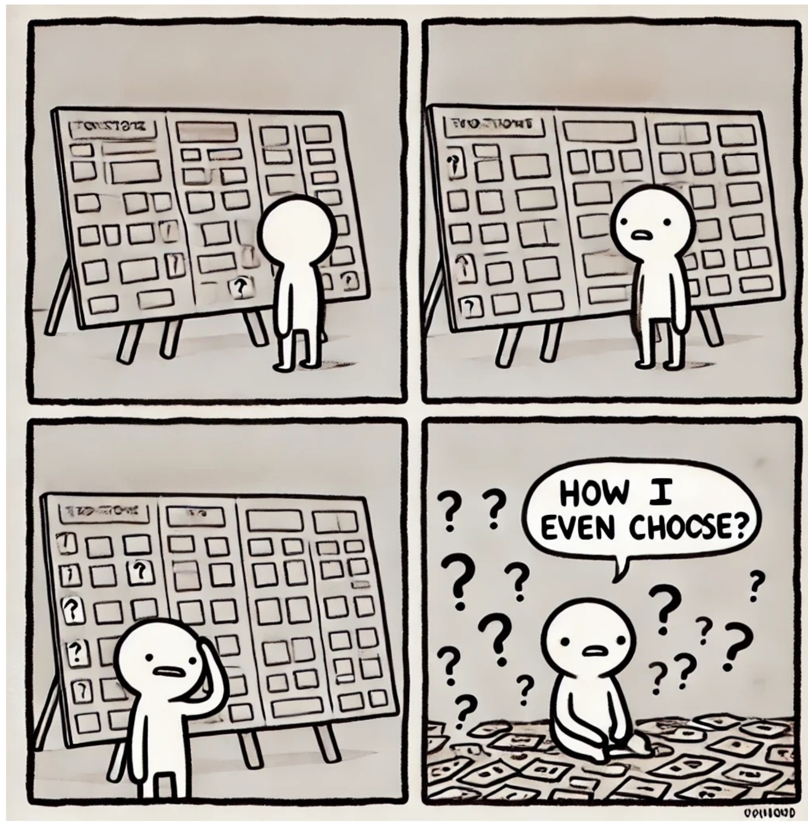
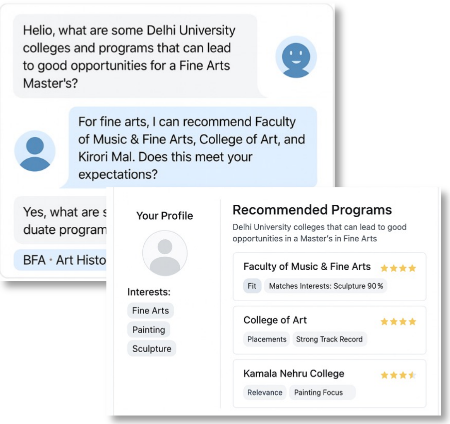
Impact of Ranking & Personalized Recommendations in Marketplaces



Omar Besbes   Yash Kanoria   Akshit Kumar
Columbia Business School   Yale CADMY

A Tale of Two Info Provisioning Tools

Personalized Recos



A Tale of Two Info Provisioning Tools

Public Rankings

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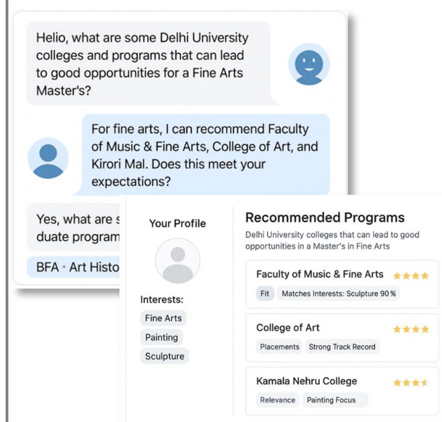
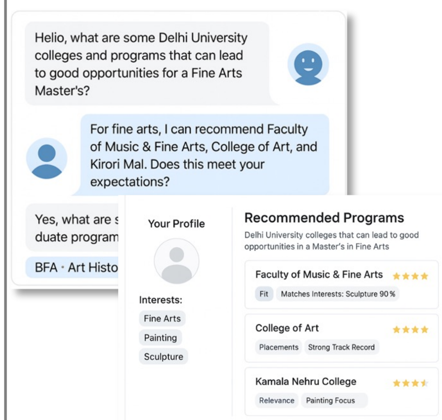


A Tale of Two Info Provisioning Tools

What is the added value of personalization?

Public Rankings　　Personalized Recos



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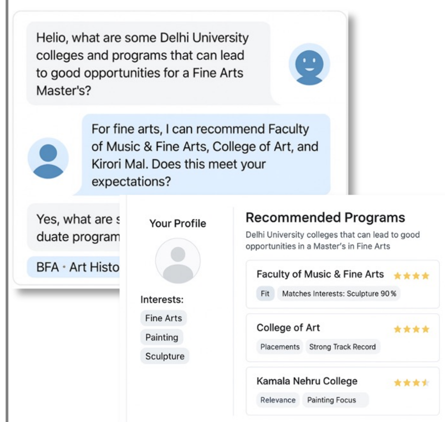
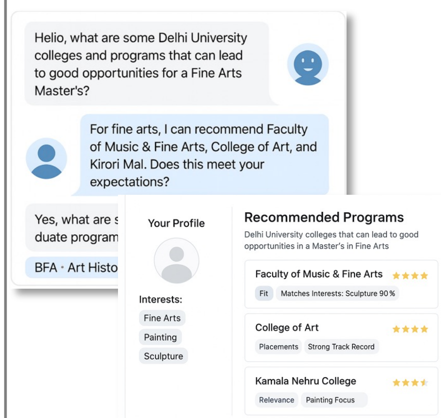


A Tale of Two Info Provisioning Tools

What is the added value of personalization?

Public Rankings | Personalized Recos

Limited Supply



Unlimited Supply

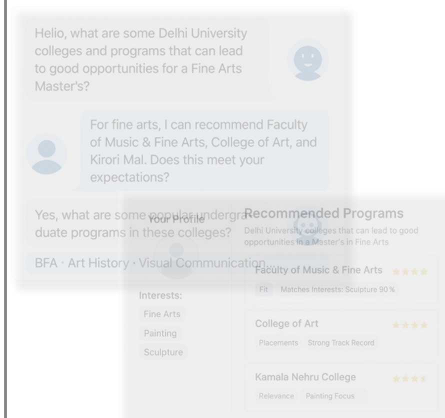
A Tale of Two Info Provisioning Tools

What is the added value of personalization?

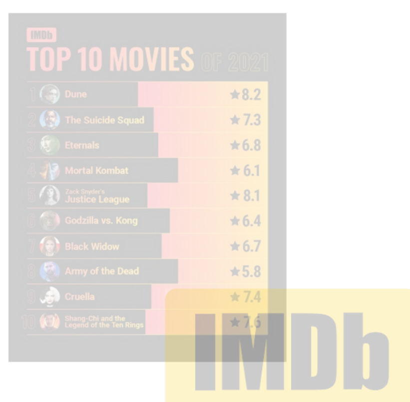
Public Rankings | Personalized Recos

What is the role of capacity constraints?

Limited Supply



Unlimited Supply



Research Problem

How much value do different information provisioning tools – **public rankings** & **personalized recommendations** - provide with & without supply side constraints?

In a Nutshell

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- Study the impact of two information provisioning tools
    - Public Rankings: Provide an overall assessment of the options
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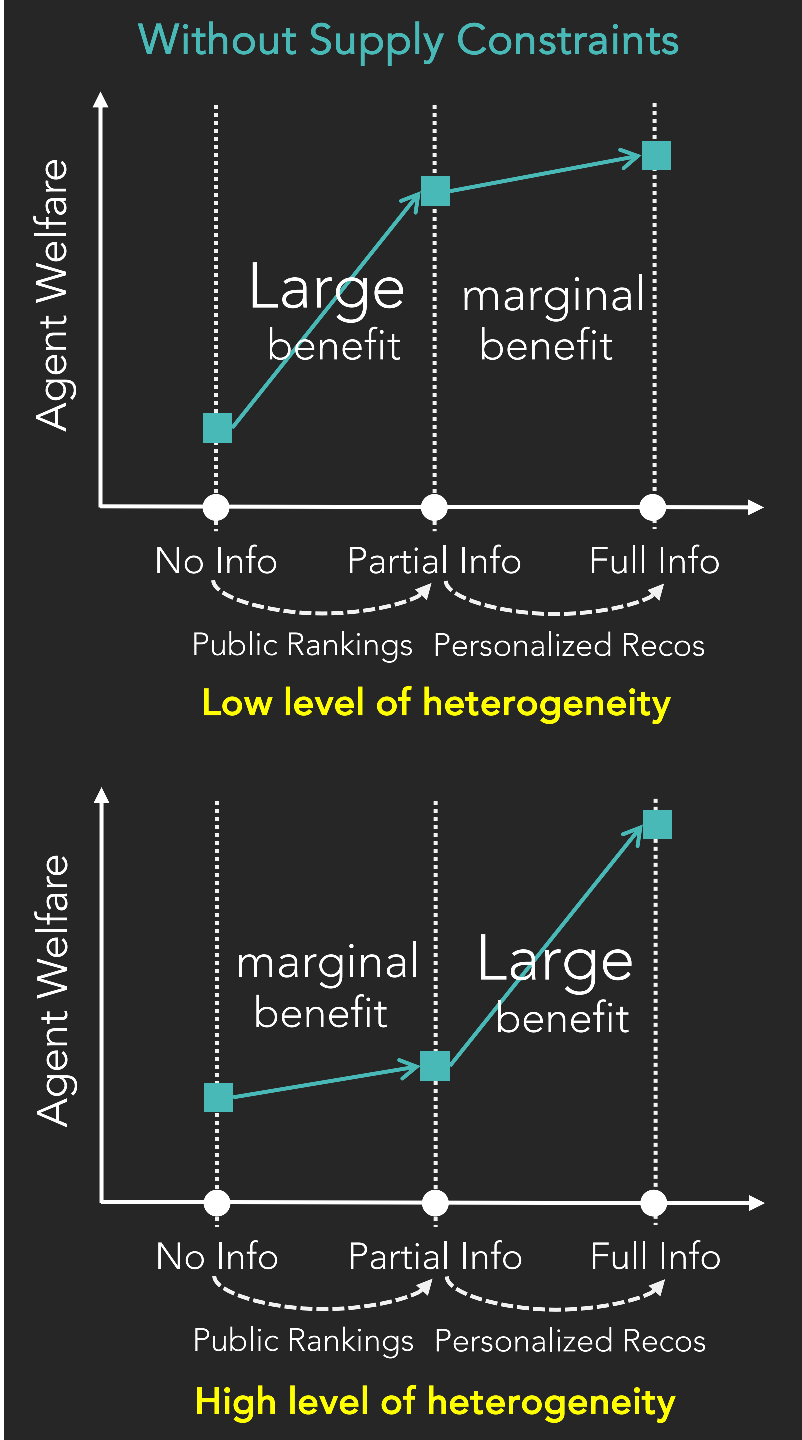

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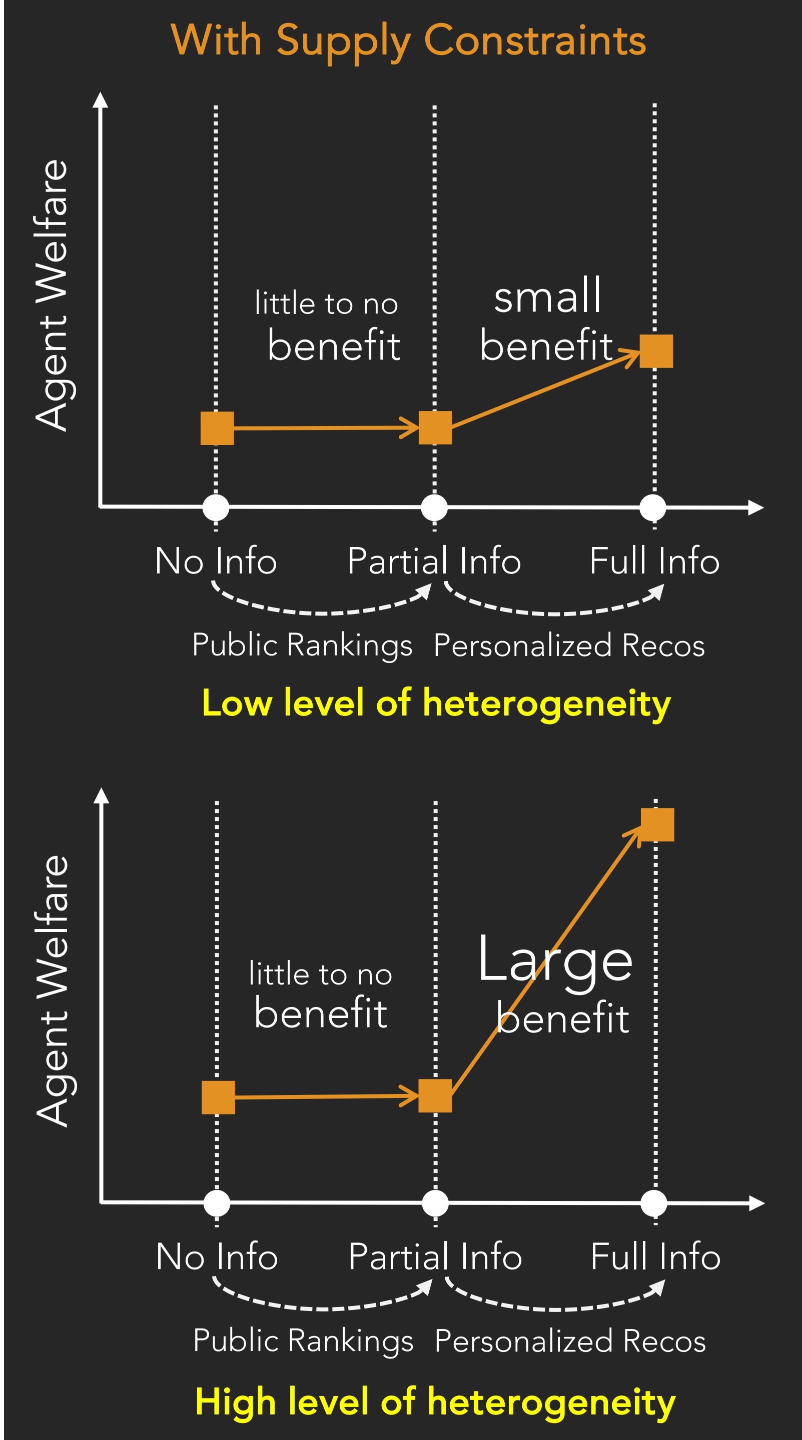
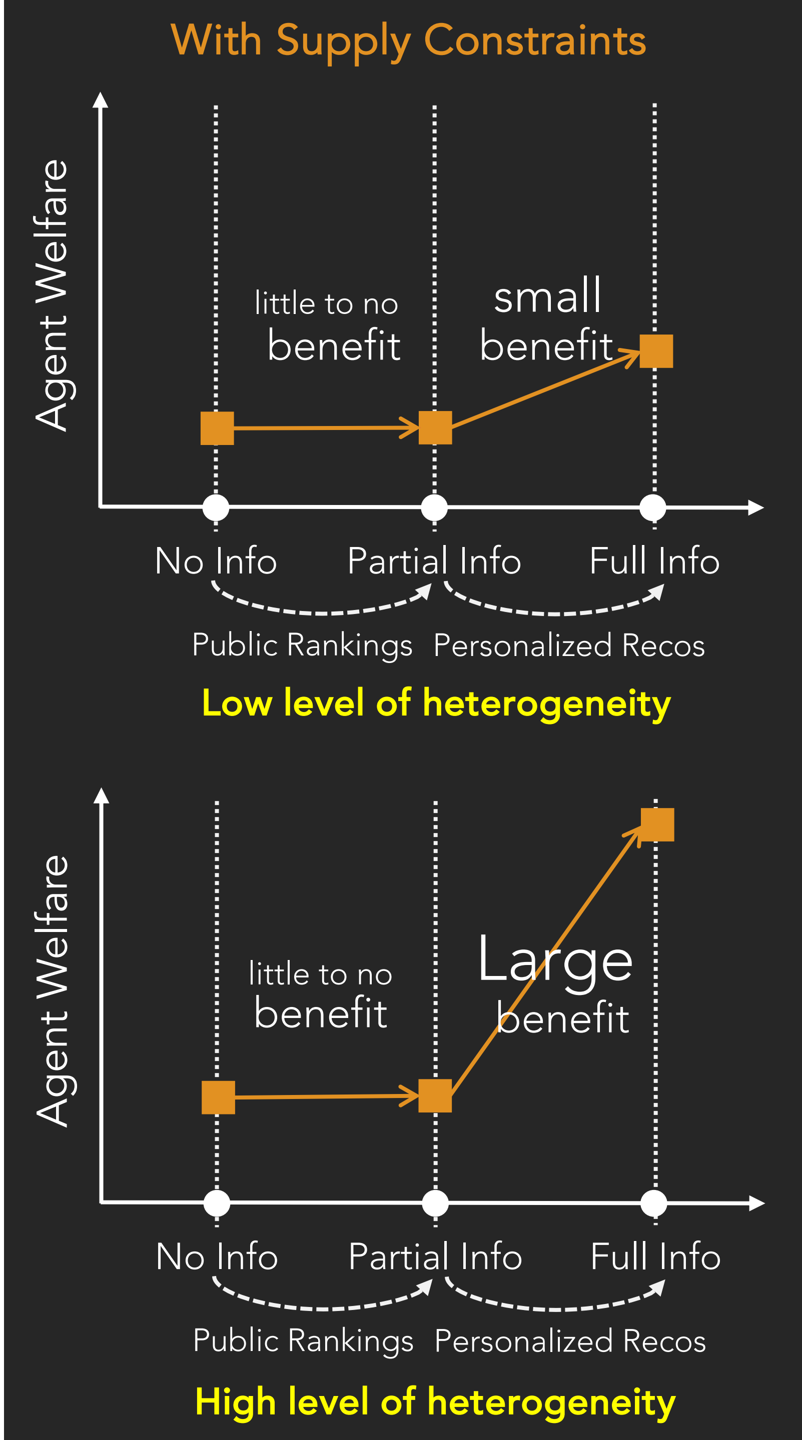


In a Nutshell

Leveling the Playing Field for High School Choice: Results from a Field Experiment of Informational Interventions

Sean P. Corcoran, **Jennifer L. Jennings**, **Sarah R. Cohodes** & **Carolyn Sattin-Bajaj**

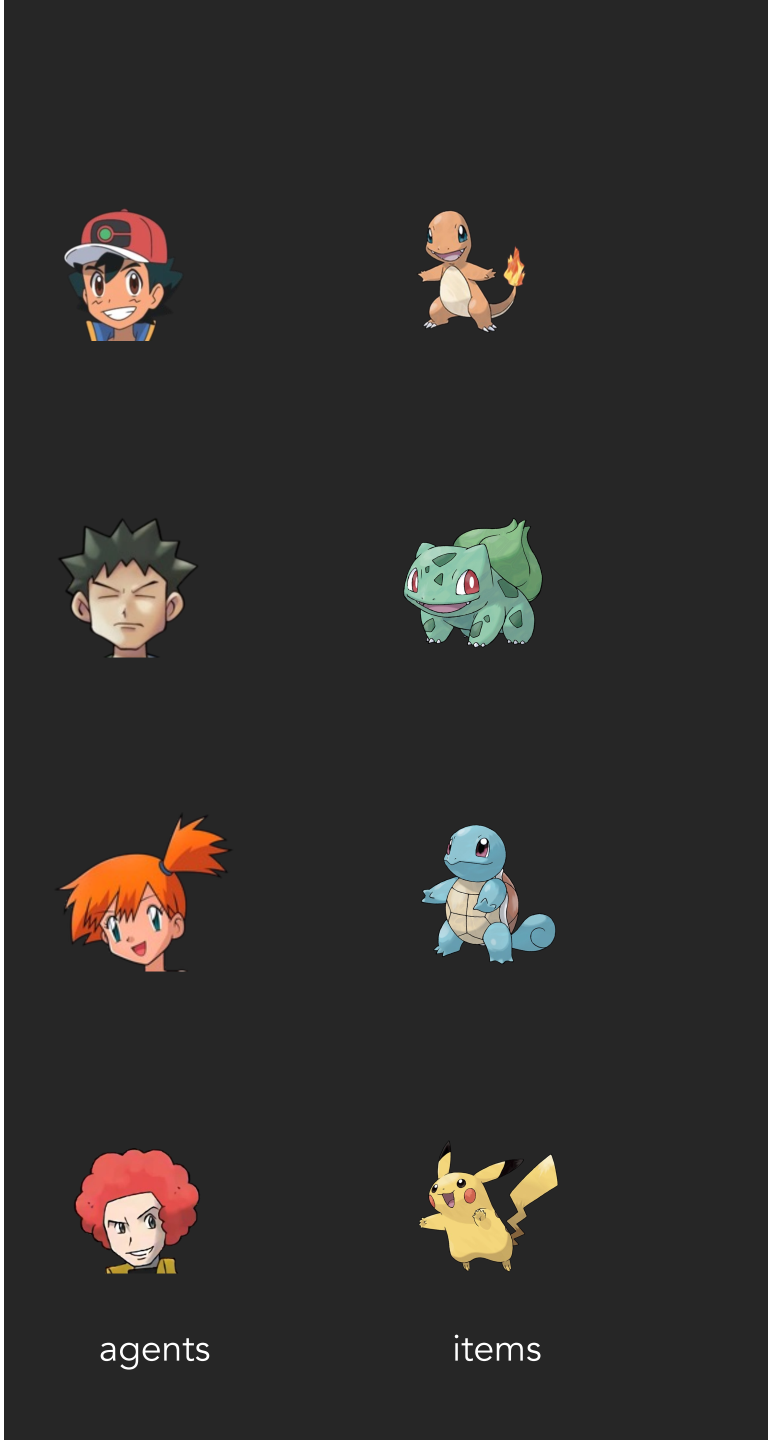
“ …. Our findings also suggest that informational interventions *may not* reduce inequality, since *both* disadvantaged and comparatively advantaged students used our materials …. ”



Model

Model

- n agents and n items



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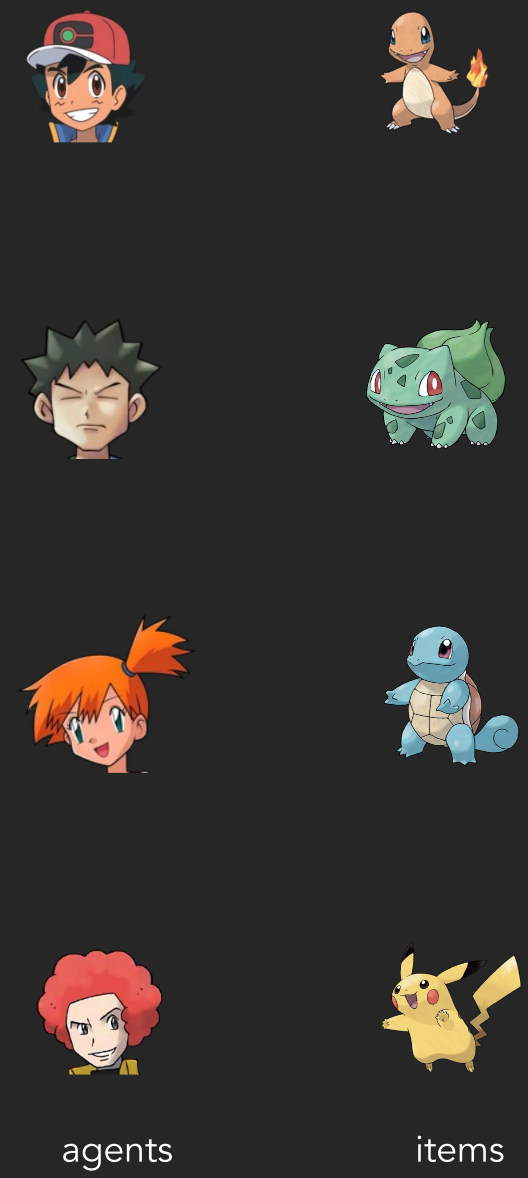
- Agent Utility
  - $U(a,i) = (1-\rho)\cdot q(i) + \rho \cdot \varphi(a,i)$



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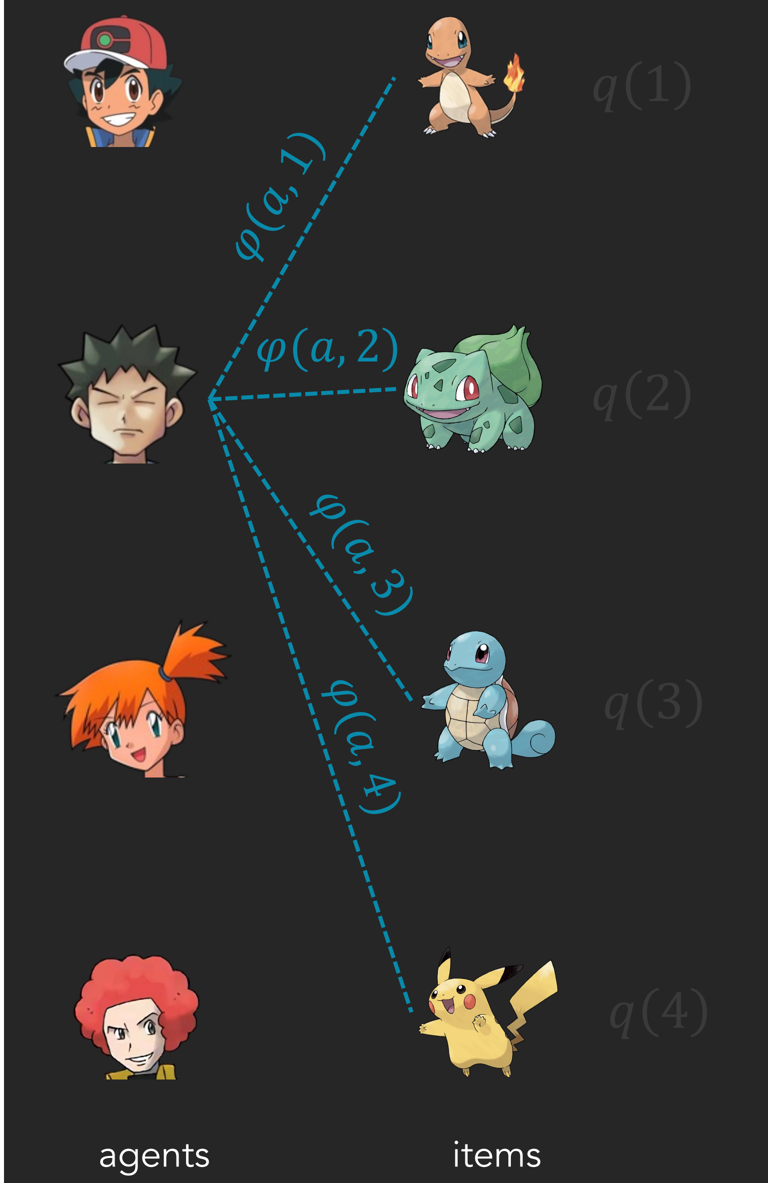

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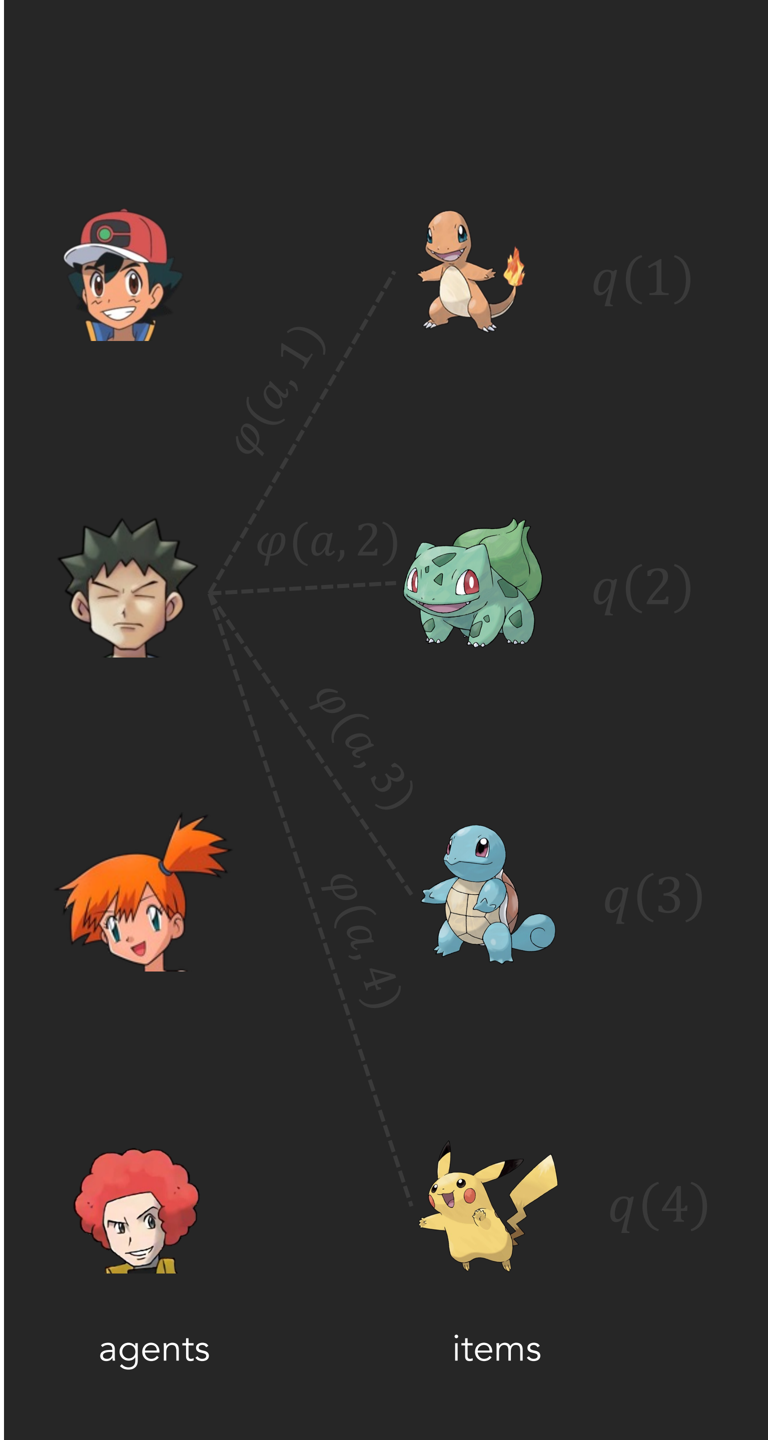

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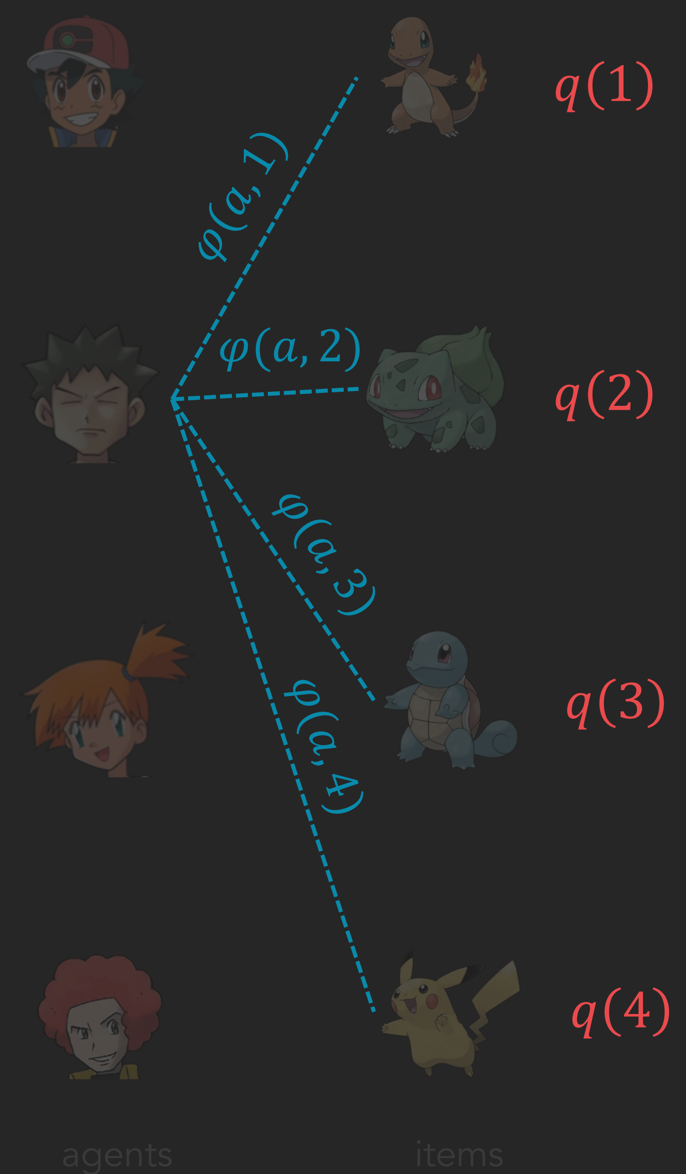
  - ρ: level of heterogeneity in utility
- Assumptions
  - q and φ are independent of each other
  - $q(i)$ drawn i.i.d from P_q
  - $\varphi(a,i)$ drawn i.i.d from P_φ



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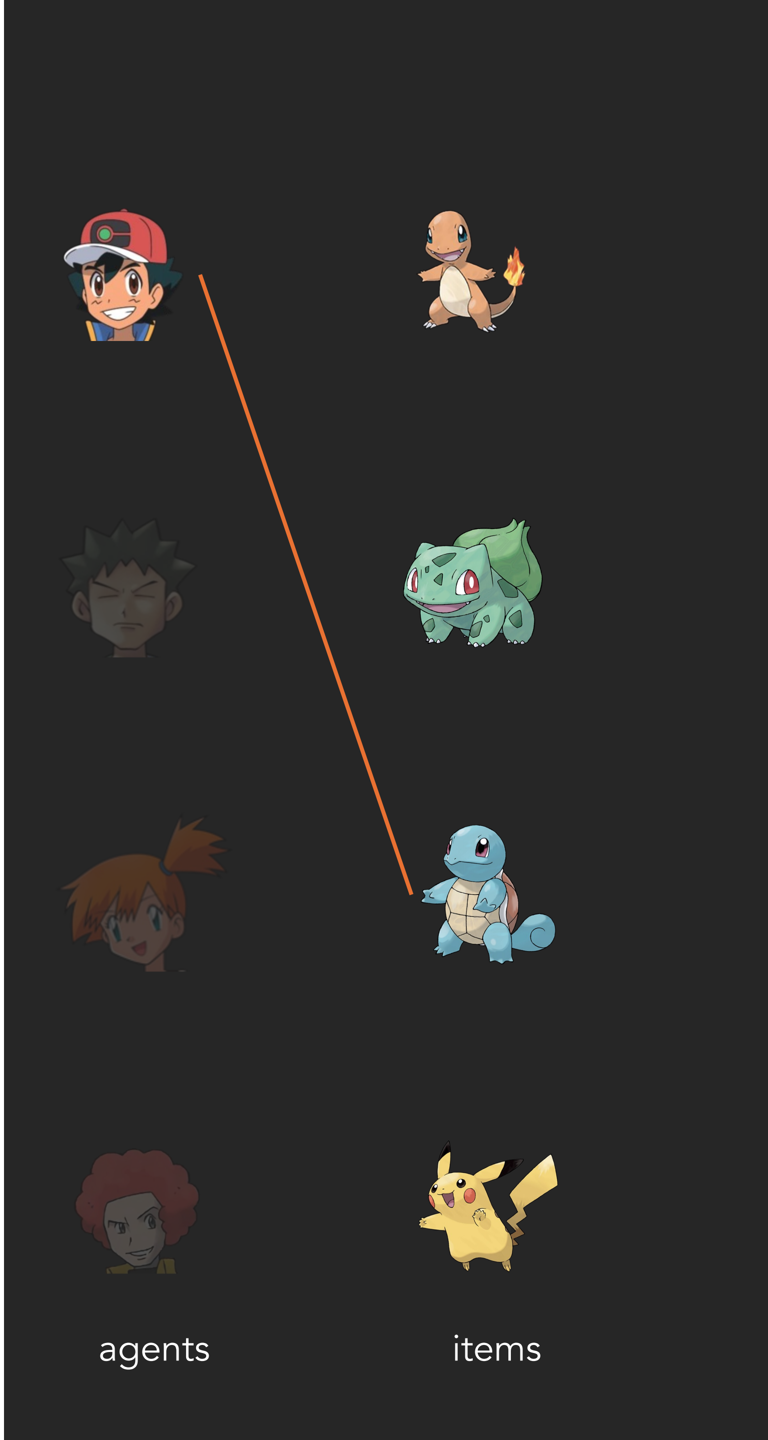

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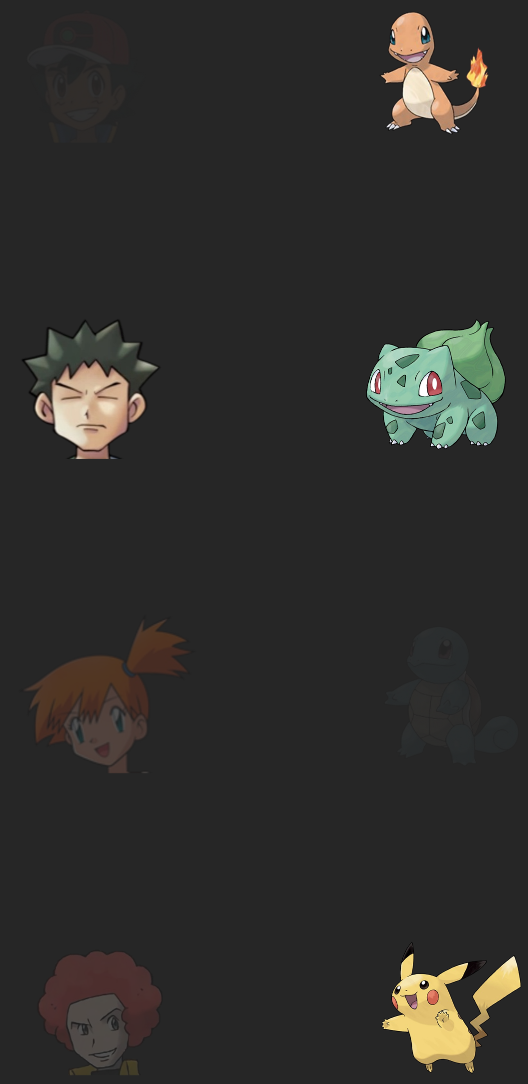

agents items

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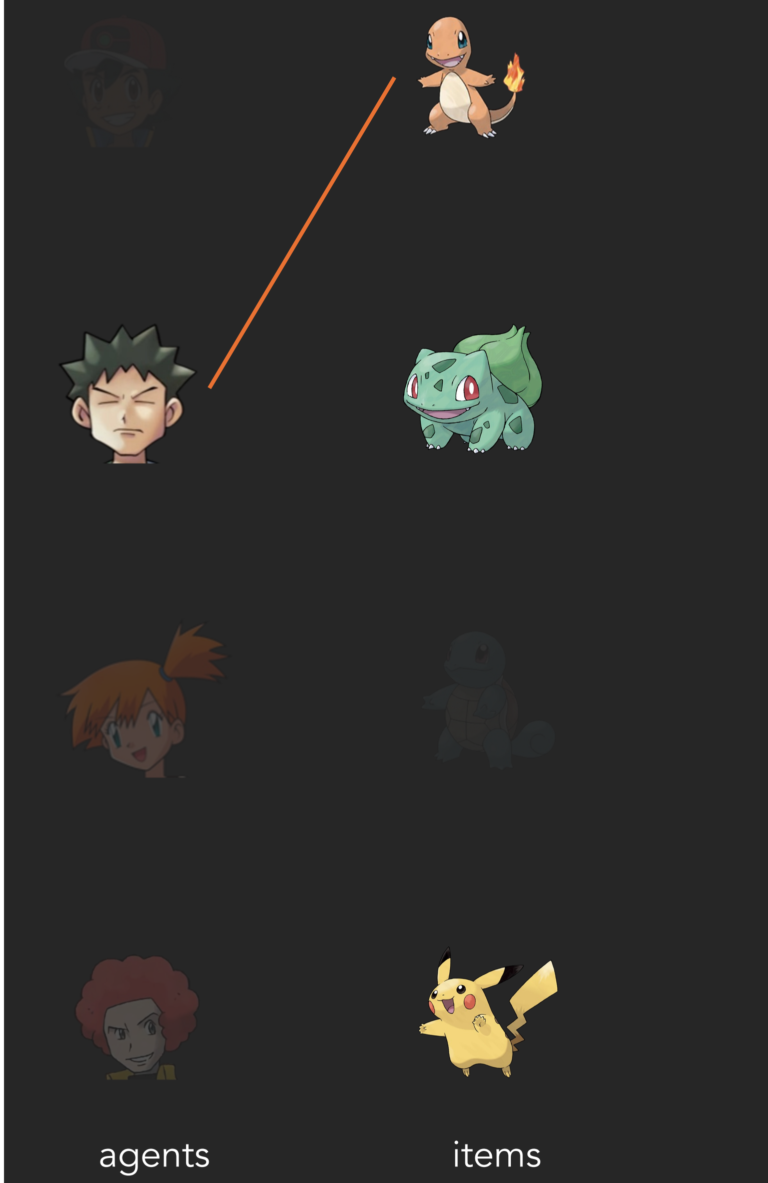

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  - Each item has unit capacity
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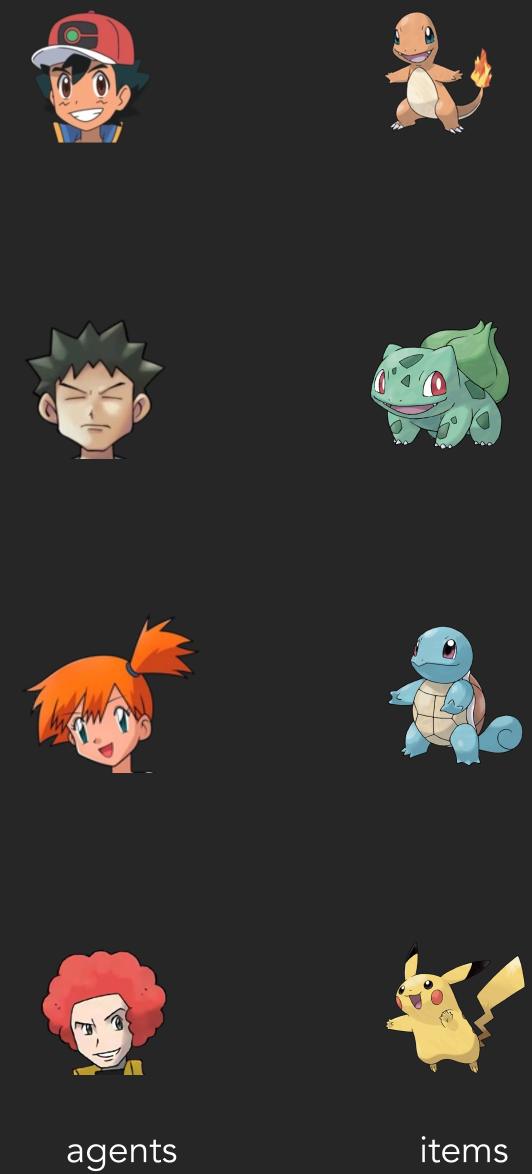

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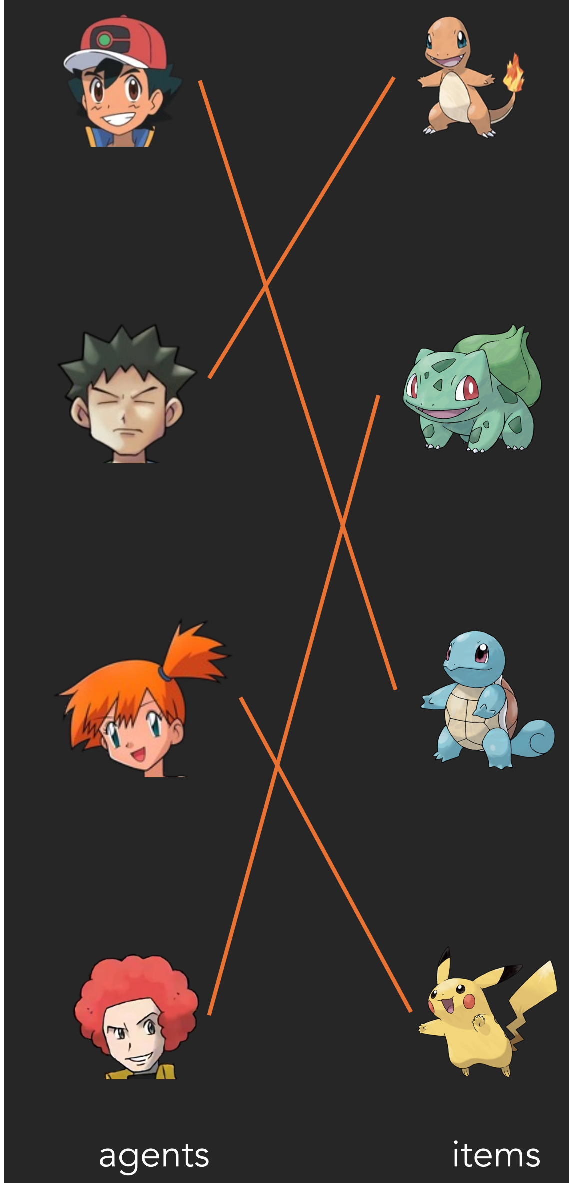

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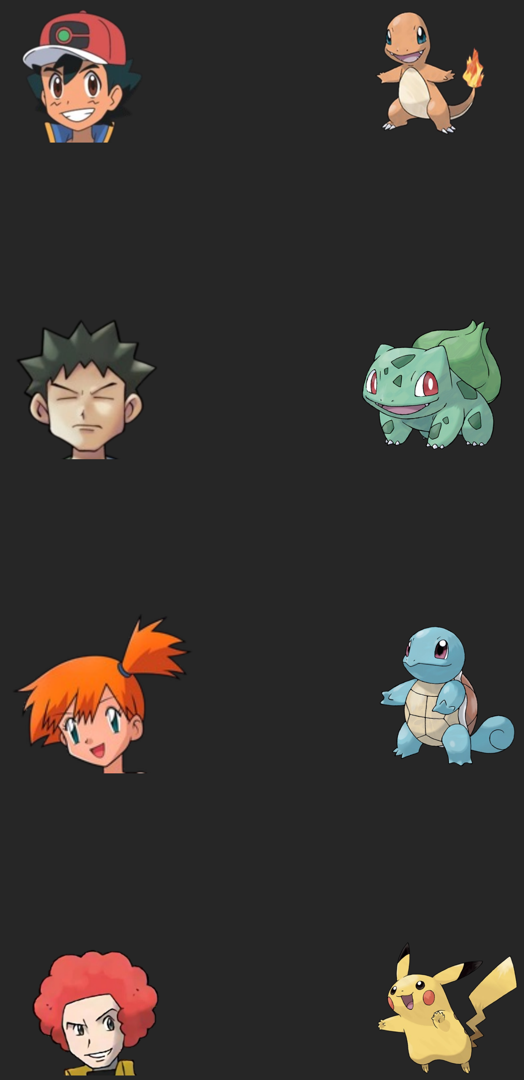

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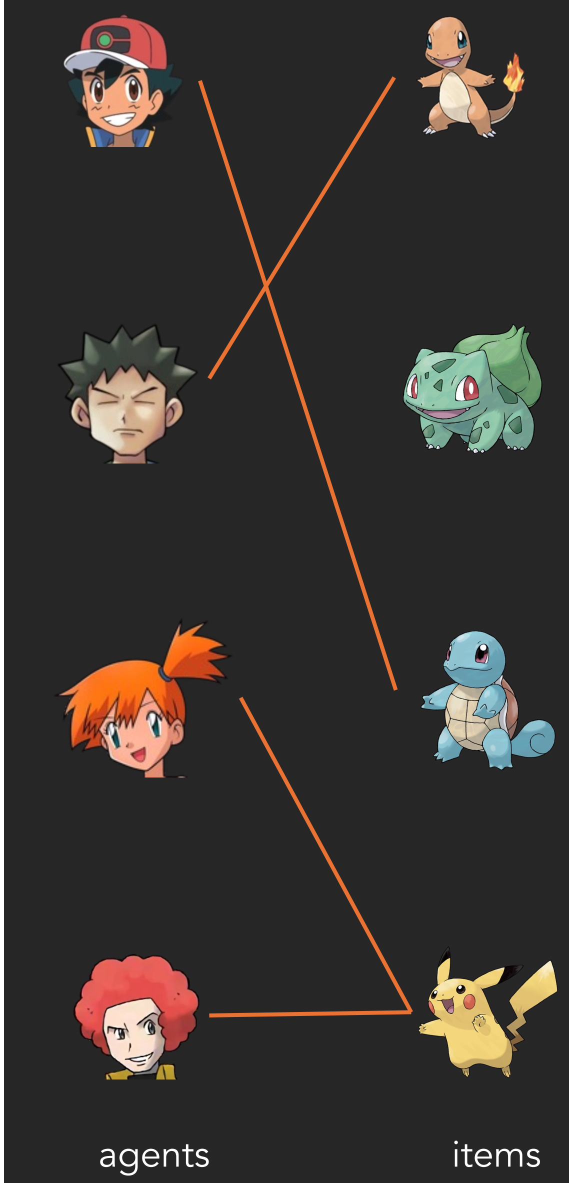

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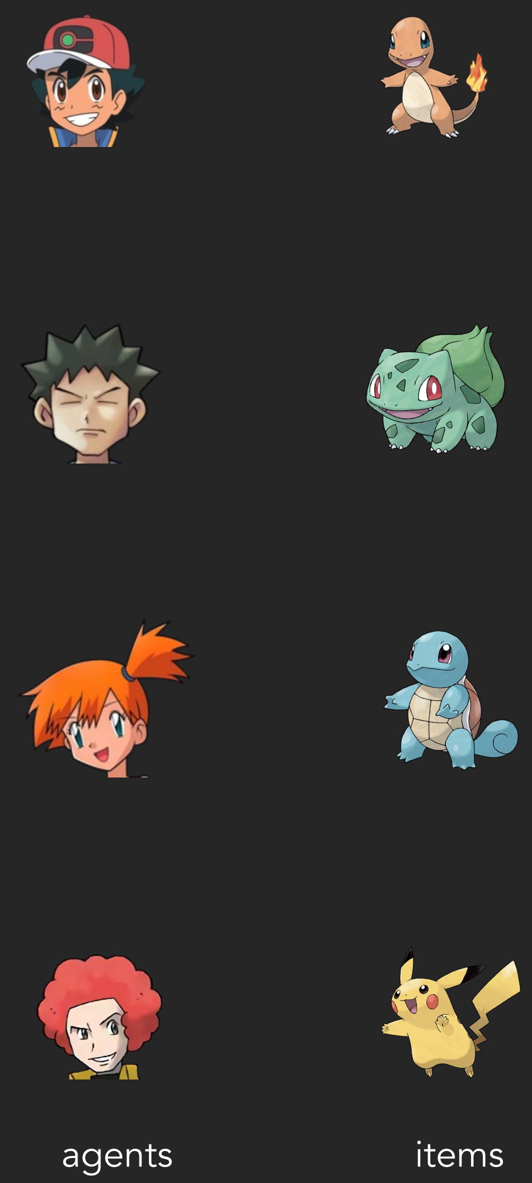

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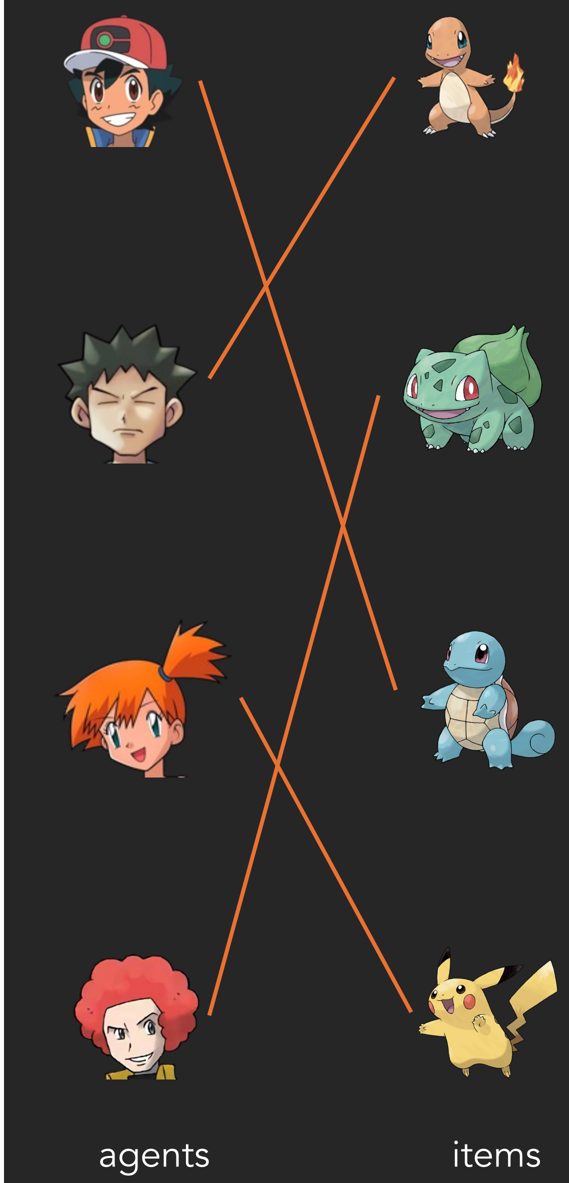

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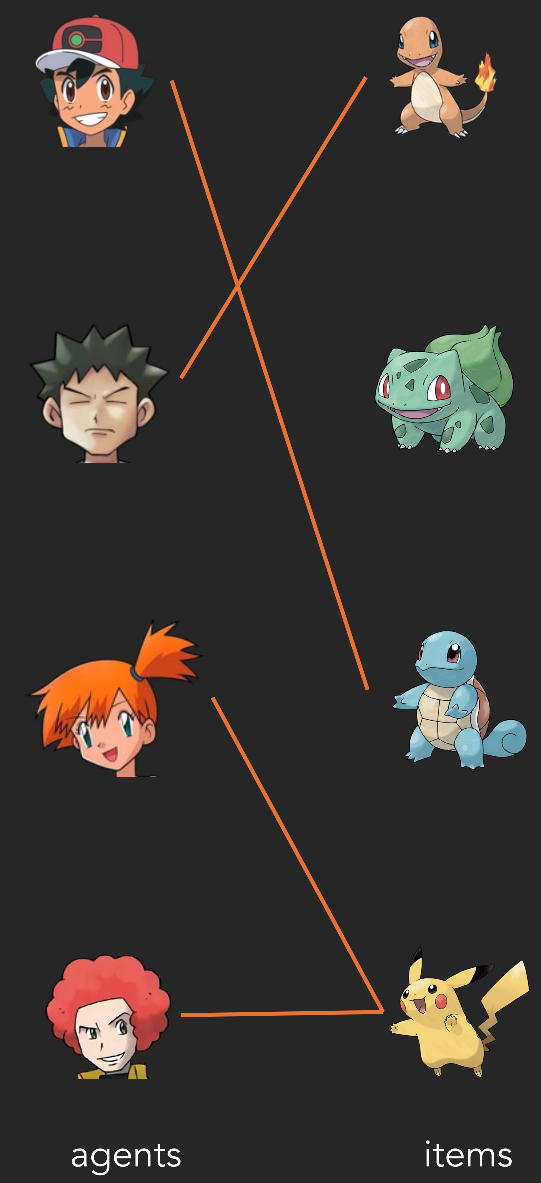

Information Regimes

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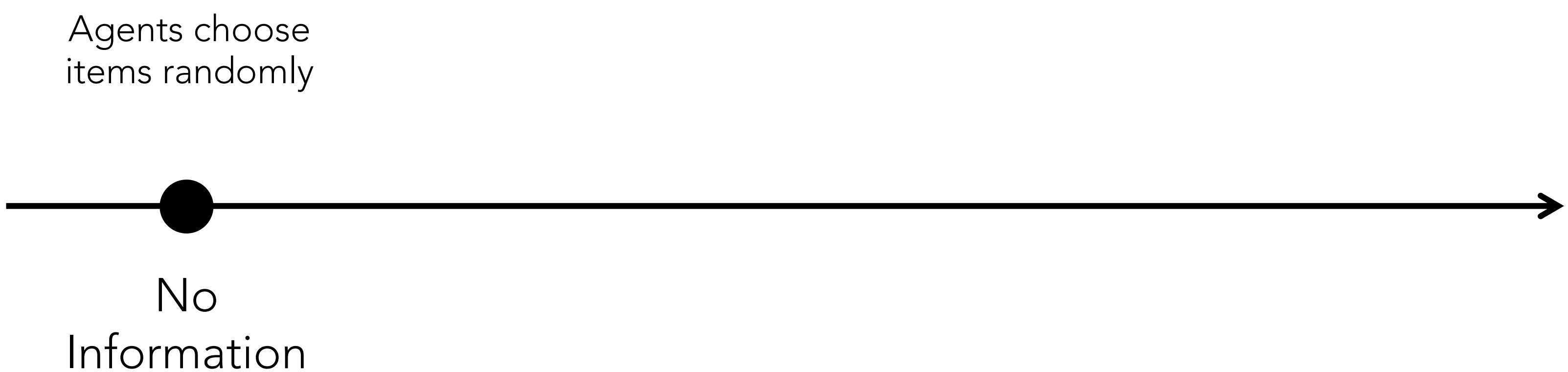
No
Information

$$U = (1-\rho)\cdot q(i) + \rho\cdot \varphi(a,i)$$

Information Regimes



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Information Regimes

Agents choose
items randomly

No
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Public
Rankings

Information Regimes

Agents choose items randomly

Agents choose items based solely on the common term

No Information

Partial Information

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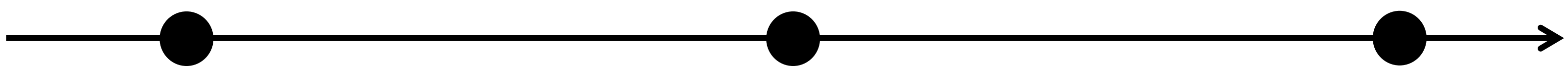

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Personalized Recommendations

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$\Delta^{\text{cap}}_{\emptyset \to q}$ $\Delta^{\text{uncap}}_{\emptyset \to q}$

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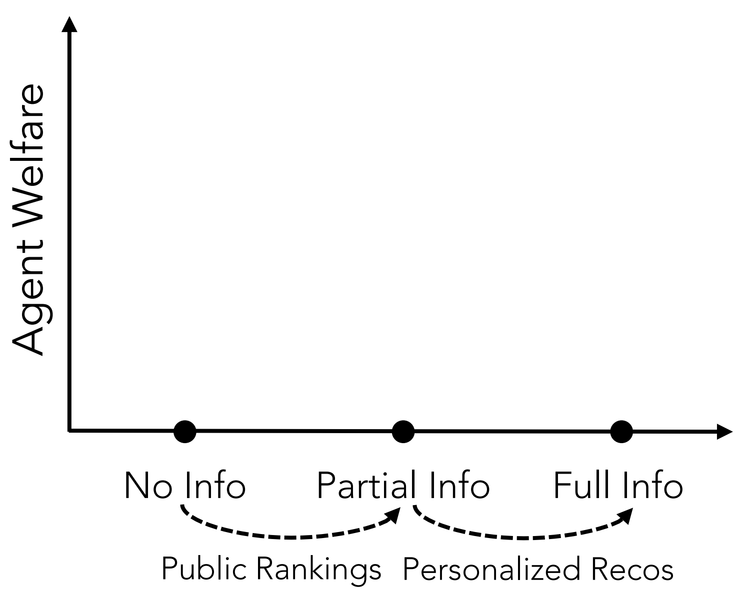

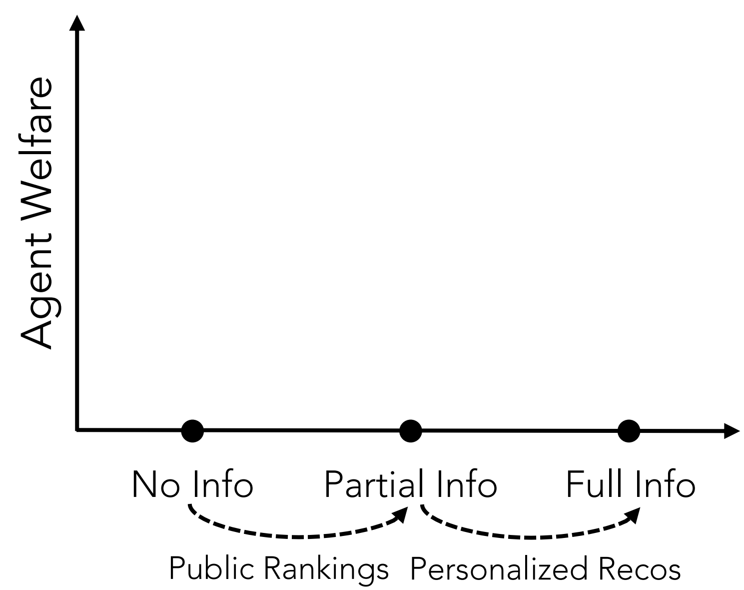

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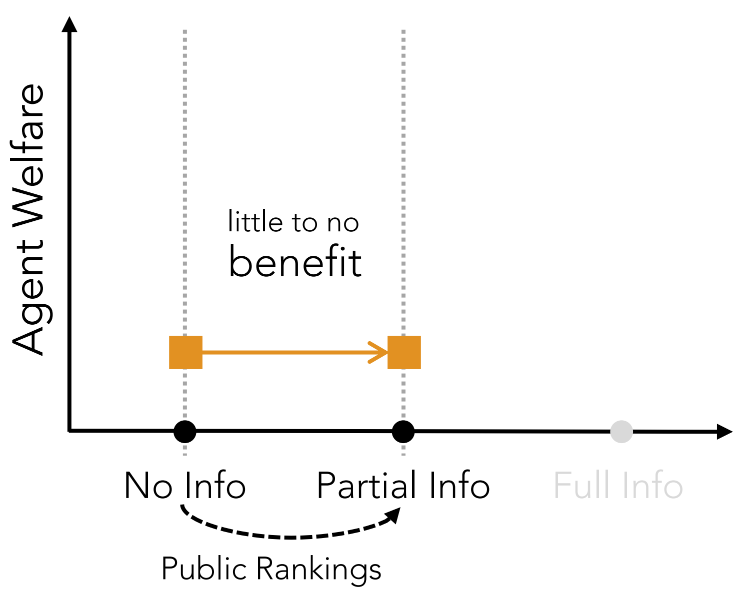

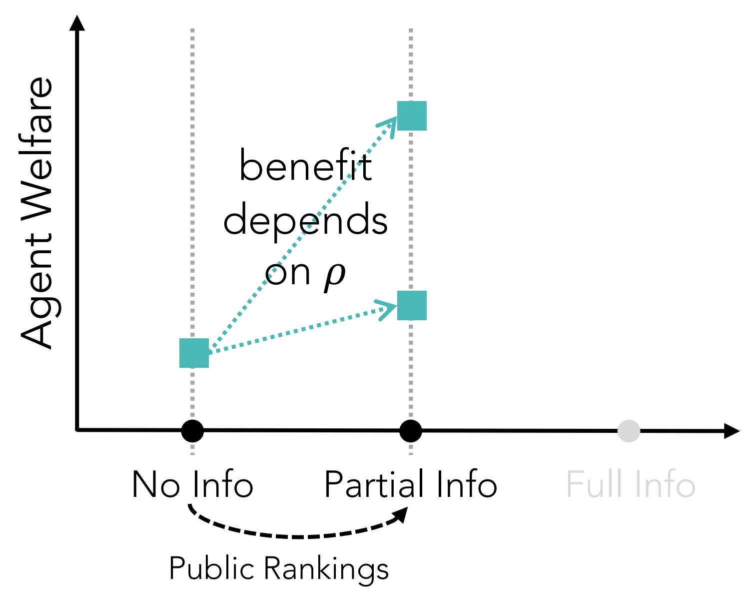

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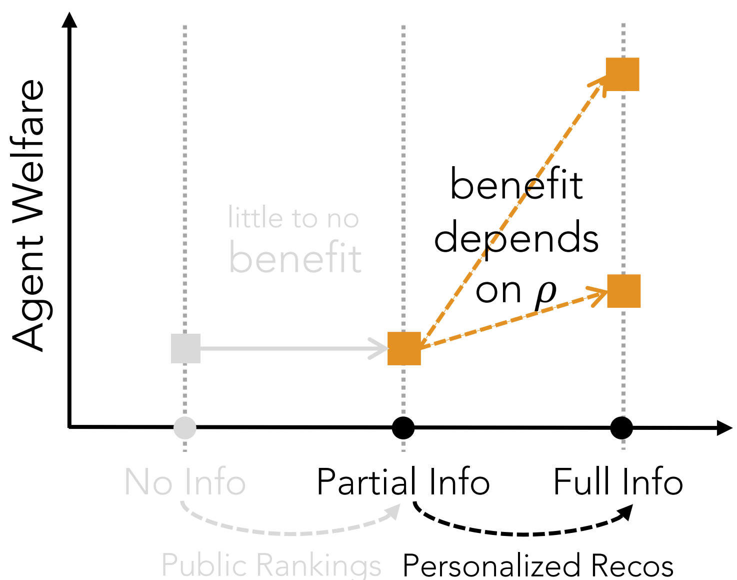

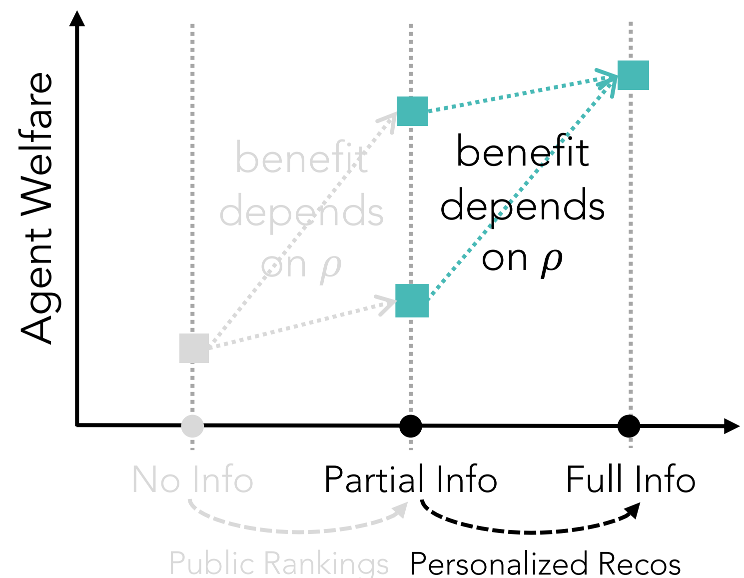

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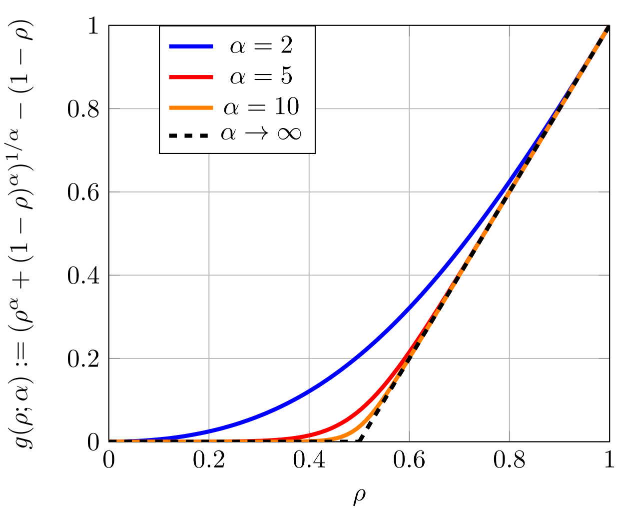
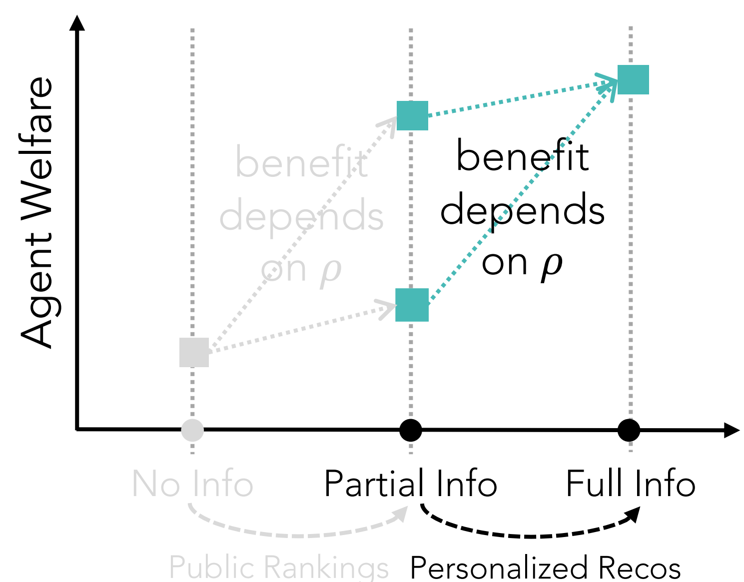
- $\Delta^{\text{uncap}}_{q\to u} \simeq c\left(\left((1-\rho)^{\alpha} + \rho^{\alpha}\right)^{\frac{1}{\alpha}} - (1-\rho)\right)\cdot n^{1/\alpha}$





Main Result (Pareto Tail)

A distribution F is said to have a Pareto tail with parameter (κ, α) if $\lim_{x\to\infty} \bar{F}(x)/(\kappa/x)^{\alpha} = 1$.

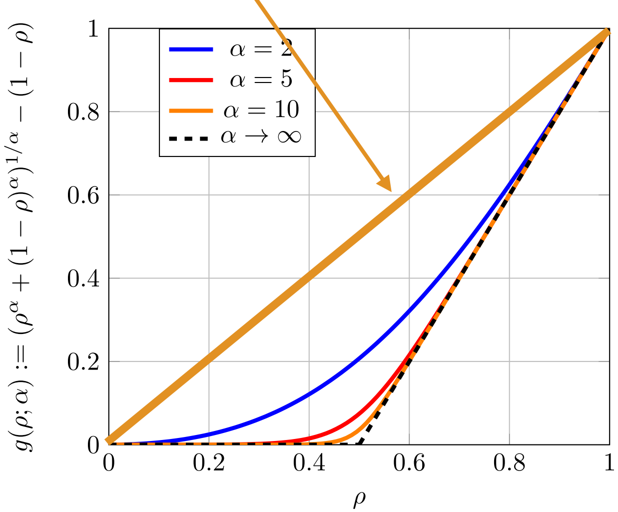
We have n agents and n items. Assume that common term distribution F_q and the idiosyncratic term distribution F_φ have Pareto tail with parameters (κ, α). Then we have that

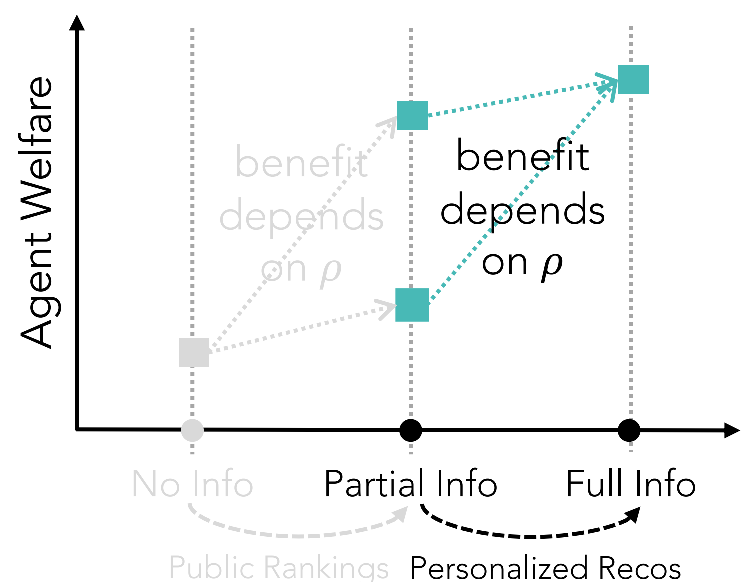
Capacitated Supply Setting

- $\Delta^{\text{cap}}_{\emptyset\to q} = 0$
- $\Delta^{\text{cap}}_{q\to u} \simeq c\rho \cdot n^{1/\alpha}$

Uncapacitated Supply Setting

- $\Delta^{\text{uncap}}_{\emptyset\to q} \simeq c(1-\rho)\cdot n^{1/\alpha}$
- $\Delta^{\text{uncap}}_{q\to u} \simeq c\left(\left((1-\rho)^{\alpha} + \rho^{\alpha}\right)^{\frac{1}{\alpha}} - (1-\rho)\right)\cdot n^{1/\alpha}$





Take-aways

- A stylized model to isolate the impact of rankings and personalized recommendations
- Fundamental interplay between the impact of different information provisioning tools and supply side capacity
  - **Uncapacitated Settings**: Level of heterogeneity determines the impact of public rankings and personalized recommendations
  - **Capacitated Settings**: Most of the value lies in matching agents to items that they idiosyncratically value highly.


Building (possibly noisy) tools which inform of idiosyncratic preferences
v/s
Building a more accurate public ranking tool

Thanks

arxiv.org/abs/2506.03369