



Sonia Kovalevsky

[Wiki](#): was the greatest woman mathematician prior to the twentieth century, the daughter of Vasily Korvin-Krukovsky, an artillery general, a well-educated member of the Russian nobility. The general was said to have been a [direct descendant of Mathias Korvin, king of Hungary](#).

[Her biography was an early inspiration for me:](#)

The wallpaper in one of the children's rooms consisted of the pages of a text from her father's schooldays, namely, Ostrogradsky's lithographed lecture notes on differential and integral calculus.



[Local inspiration:](#)
[Vera T. Sós of Eötvös University](#)

Learning and Efficiency of Outcomes in Games

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Based on joint work with Thodoris Lykouris
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Large population games: traffic routing



- Traffic subject to congestion delays
- cars and packets follow shortest path
- Congestion game = cost (delay)
depends only on congestion on edges

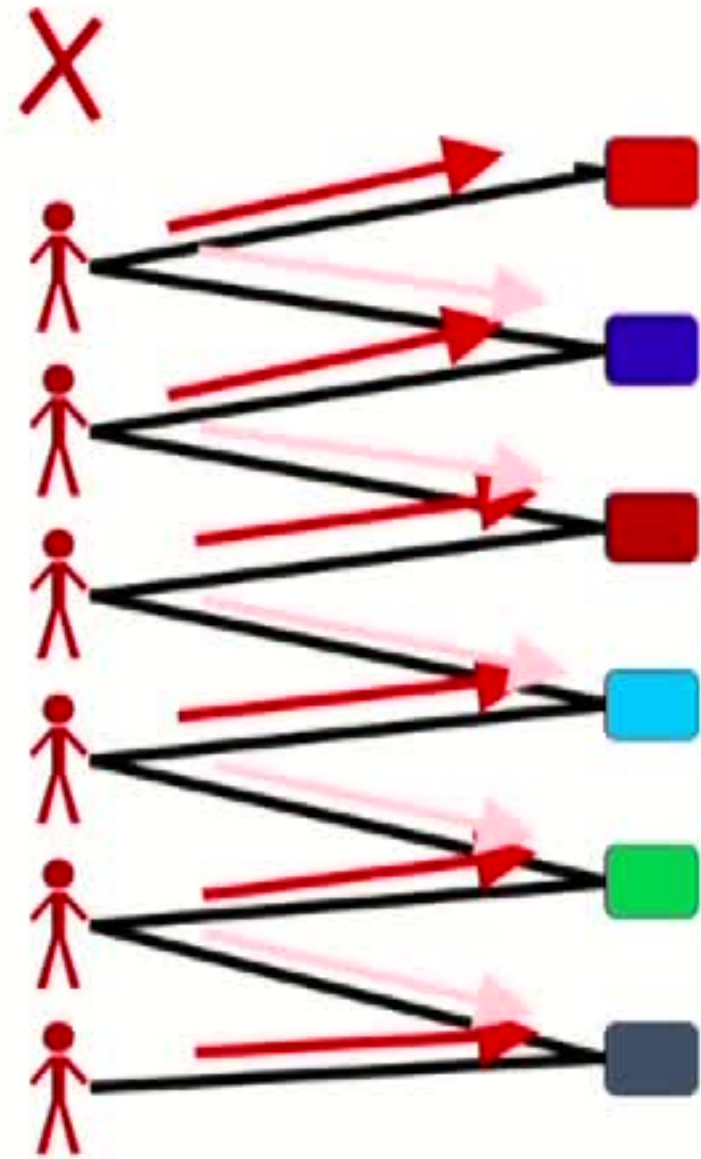
Traffic streams change

e.g., popular sites may change
Changes in system setup

Change in Optimum Solution

True optimum is too sensitive

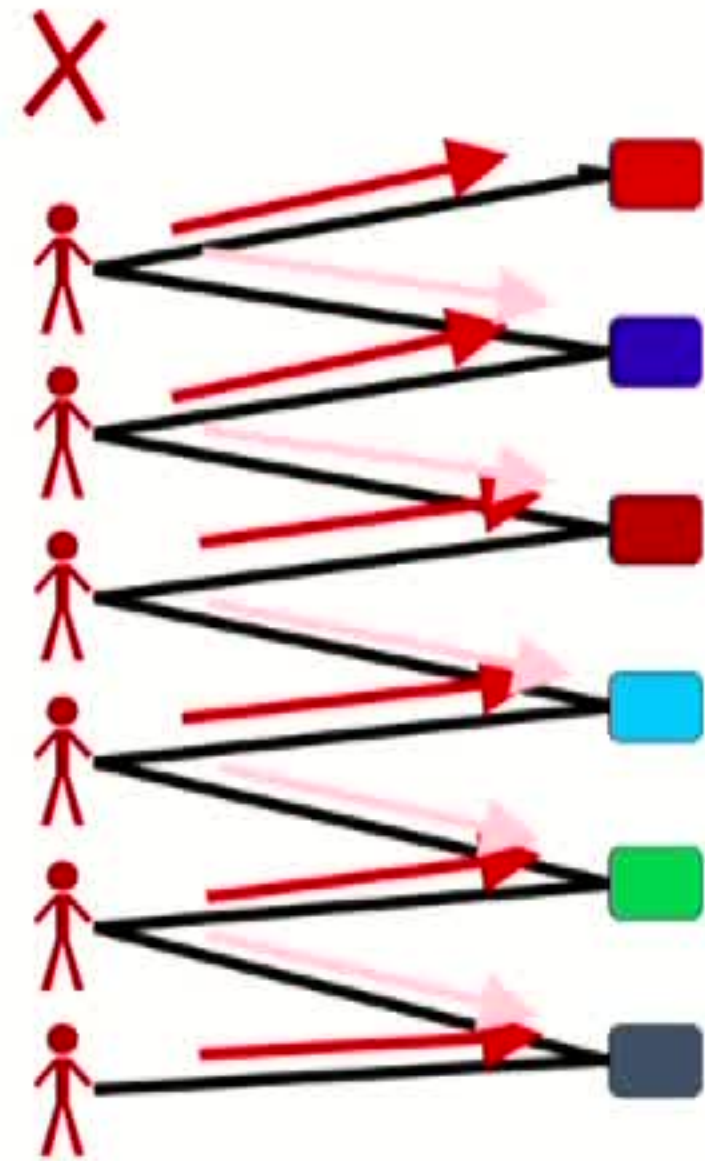
- Example using matching
- The optimum solution
- One person leaving
- Can change the solution for everyone



Change in Optimum Solution

True optimum is too sensitive

- Example using matching
- The optimum solution
- One person leaving
- Can change the solution for everyone
- Np changes each step \rightarrow No time to learn!! (we have $p \gg 1/N$)



Result (Lykouris, Syrgkanis, T'16) :



In many smooth games welfare close to Price of Anarchy **even when the rate of change is high**, $p \approx \frac{1}{\log n}$ with n players, assuming **adaptive** no-regret learners

- Worst case change of player type \Rightarrow need for learning players
- Bound $\alpha \cdot \beta \cdot \gamma$ depends on
 - α price of anarchy bound as game gets large, goes to 1 in auctions, goes to 4/3 in linear congestion games
 - γ loss due to regret error goes to 1 as $p \rightarrow 0$
 - β loss in opt for stable solutions goes to 1 as $p \rightarrow 0$ & game is large