

**2007 Lake Arrowhead
Conference
On Human Complex Systems**

**Prediction Markets as an Aggregation
Mechanism for Collective Intelligence**

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April 28, 2007

Collectively Intelligent Systems

CI System

Aggregation Mechanism

Recommender system

Collaborative filtering

Voting system

Direct democracy

Document ranking

PageRank

Folksonomies

Collaborative tagging

Prediction market

Market scoring rule

The System

Prediction market: A forecasting tool where contracts for specific event outcomes are bought and sold and their price reflects the probability that the outcome will take place.

- A contract value increases only with a commensurate decline in value of the other contracts
- Contracts are valued between \$0 and \$100, interpretable as a probability.

The System - Payout

Expiration: Those holding contracts in the event that took place earn \$100 dollars for each stock they own in the contract. Stocks in all other contracts are valued at \$0.

The System - Stats

- The Iowa Electronic Markets (IEM) in the 2004 presidential election correctly predicted the number of electoral votes by which Bush would win.
- In 2005, the Hollywood Stock Exchange correctly identified every winner in the 8 Oscar categories traded.

The System - Stats cont.

- The IEM out-predicts polls 75% of the time.
- Used by Google, Yahoo!, Intel, HP, and Microsoft

“DRAM price estimates went from 4% with traditional methods to 2.5% off with PM and with much less time and effort.”

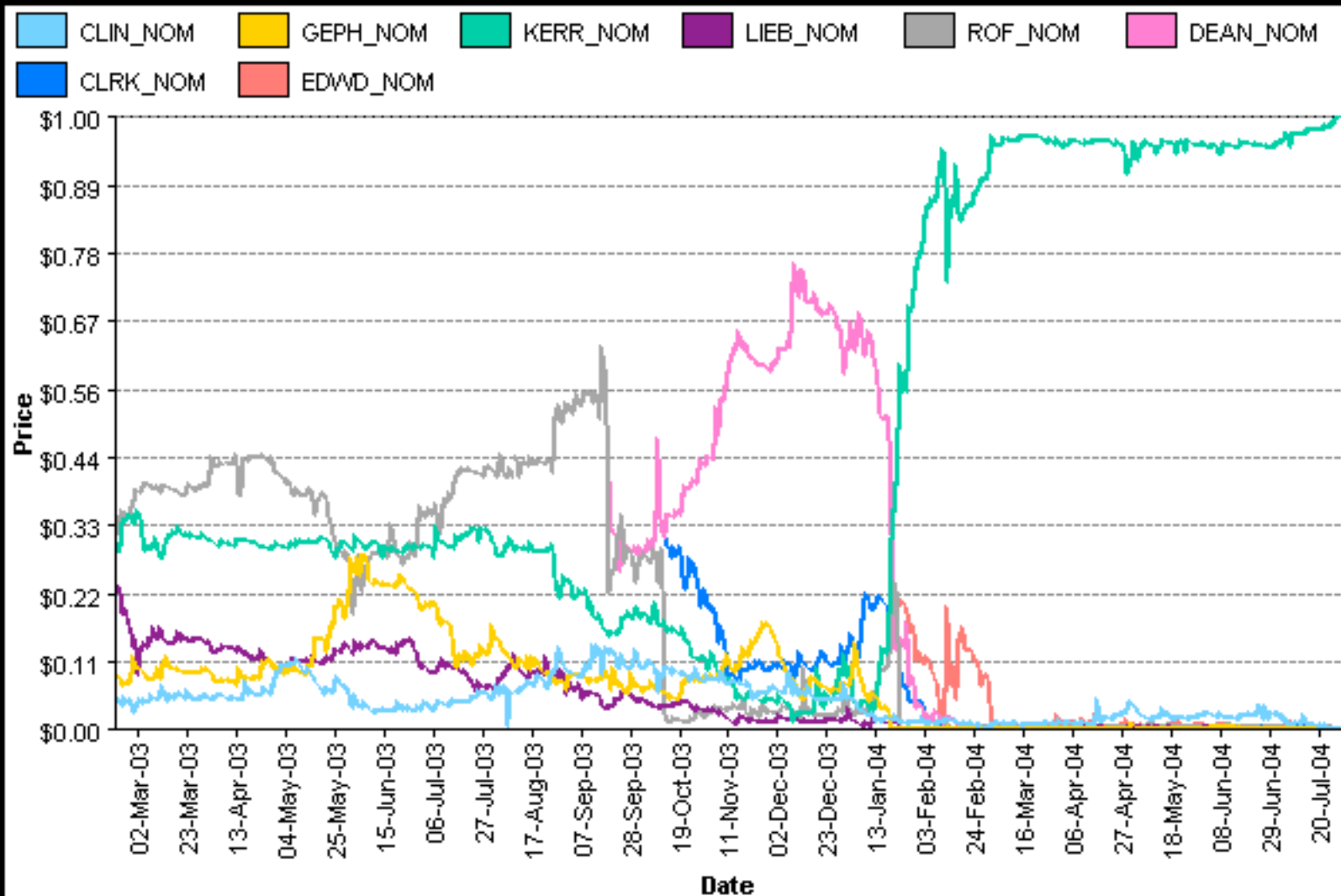
What characteristics of the collective and dynamics of the aggregation mechanism lead to a collectively intelligent system?

Traditional Simulation Methods

- Assume rational agents with complete information
- Assume bounded rational agents
- Assume random agents
 - London stock exchange
(zero intelligence traders)

Iowa Electronic Markets

real-money political prediction markets



The Data

- Information revealed along friendship edges
- Personal valuations are the sum of initial individual preferences and n th order friend preferences

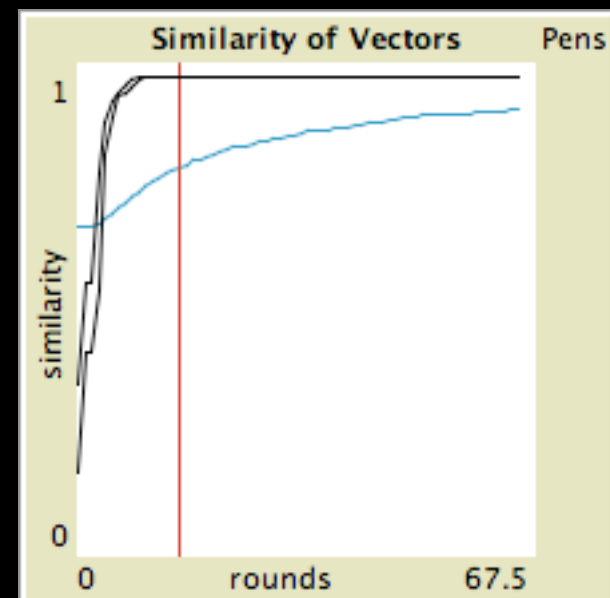
Collective Decision Making Systems

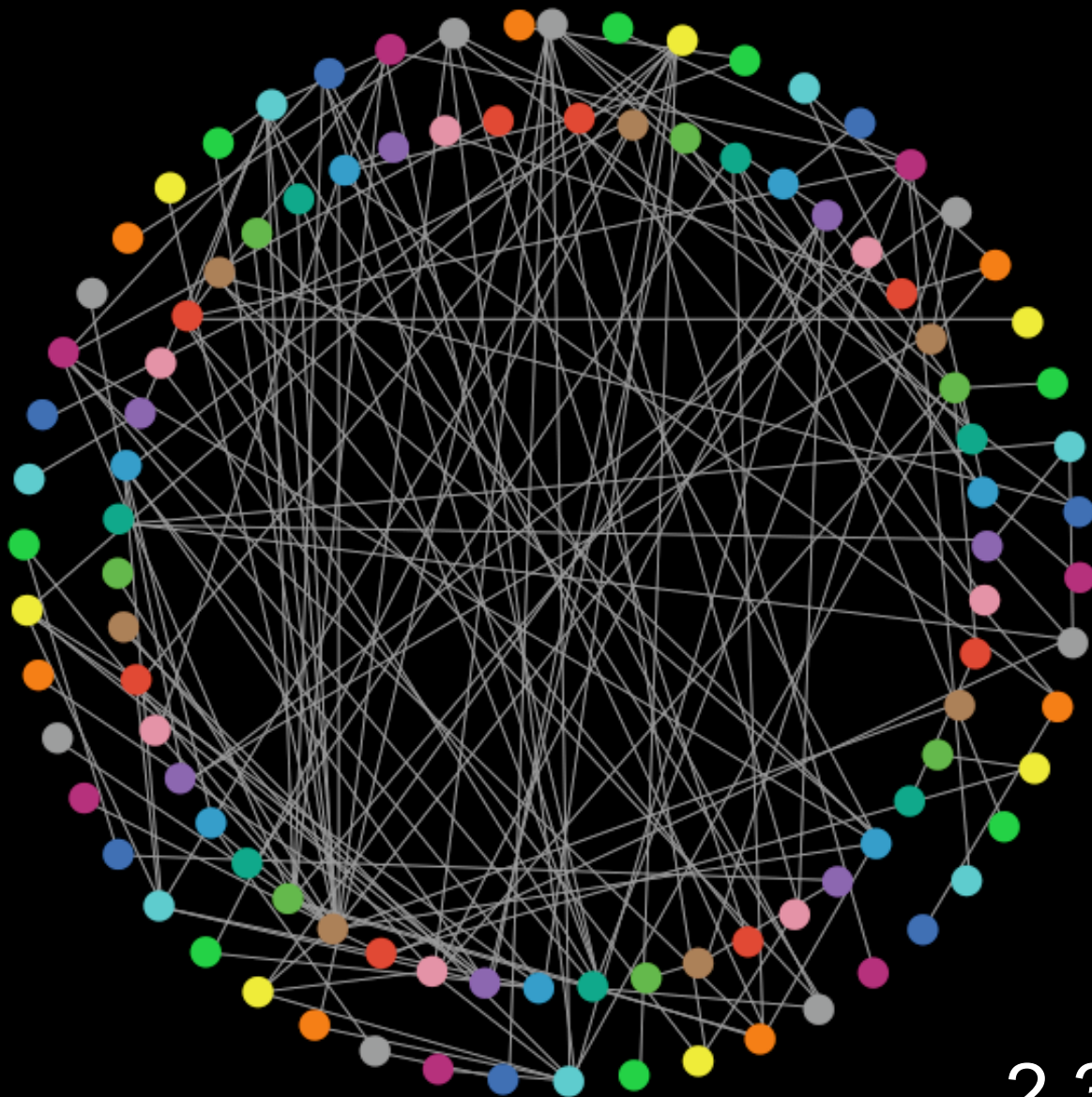
Approval Vote

Vote for any number of options.

- Joe Smith
- John Citizen
- Jane Doe
- Fred Rubble
- Mary Hill

Prediction Market





101 traders
161 edges

1,397 contracts
2,344 preferences

Market Format

- Simulating a prediction market using pre-established outcomes and trader data
- Market Scoring Rules: Trader can always buy or sell
- Short selling and debt are allowed

The Program

- Trader perspective: incomplete information revealed through time
- Omniscient perspective: complete information

Difference Between program and market

- Purity of information
- Restricted participation
- Ordered participation
- Choose first available stock

Why do certain traders win?

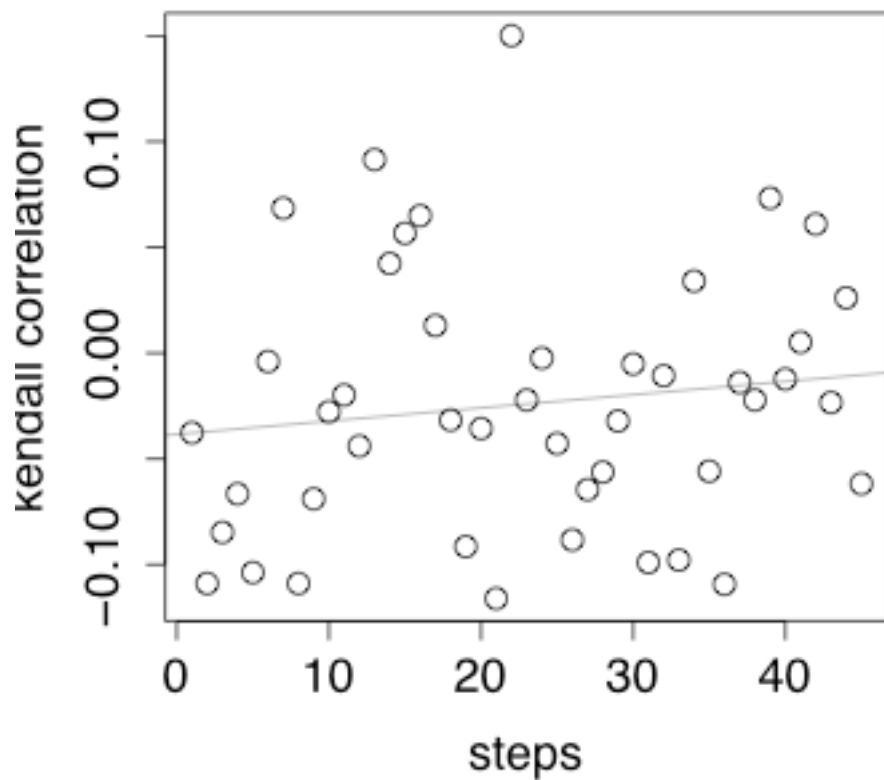
- Two types of winner

commodities market prediction market	prediction market
Most earnings - cash + portfolio value	Predictive power - Portfolio value based on actual value

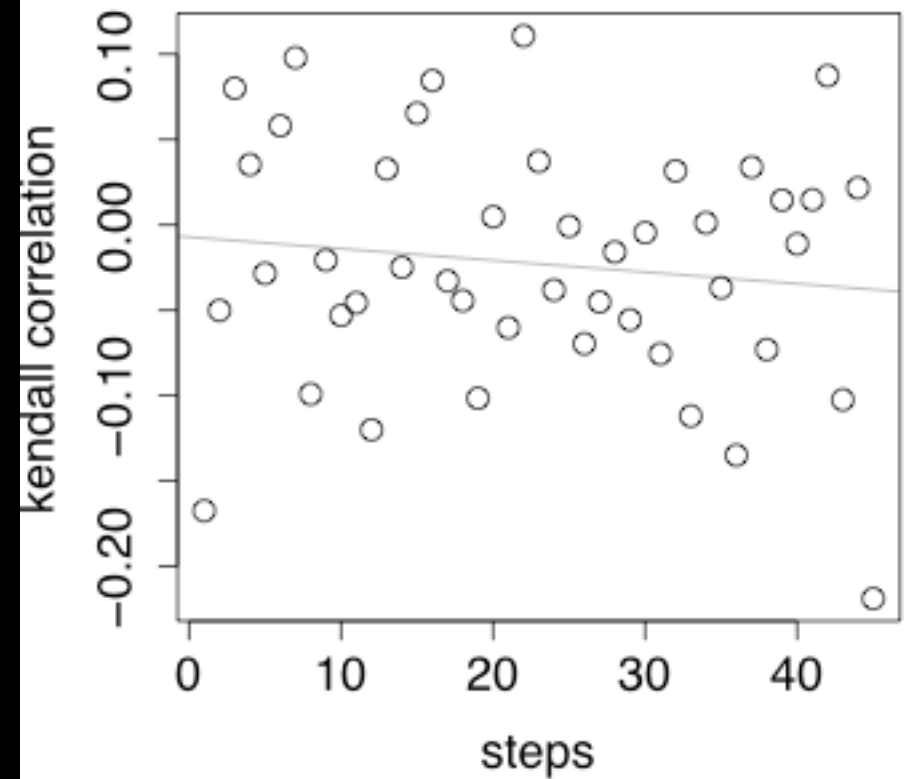
Hypotheses

- Trade order
- Degree centrality
- Original information
 - greatest amount of original information
 - most confident

Trade-order

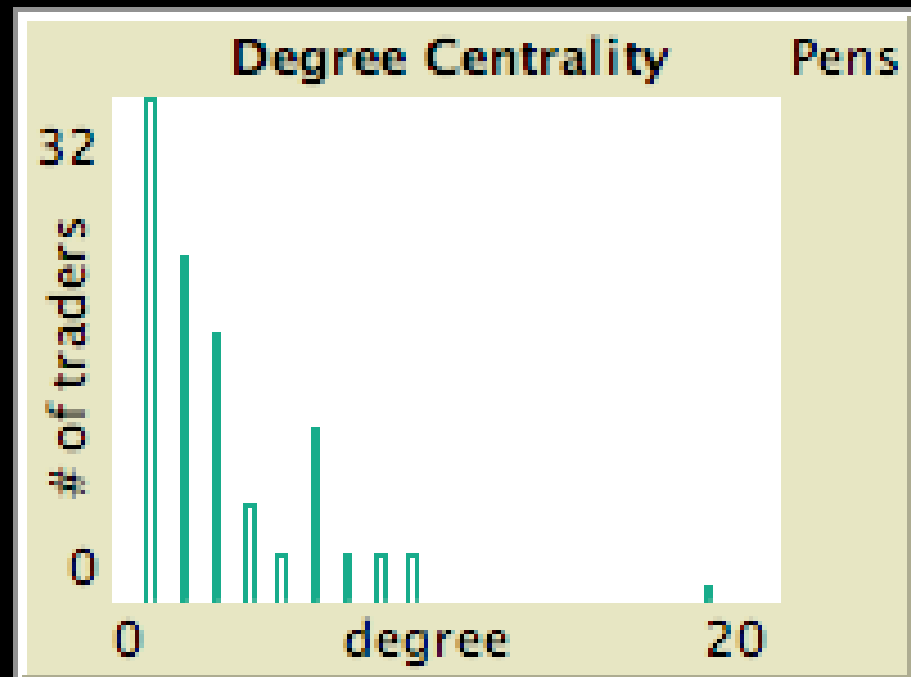
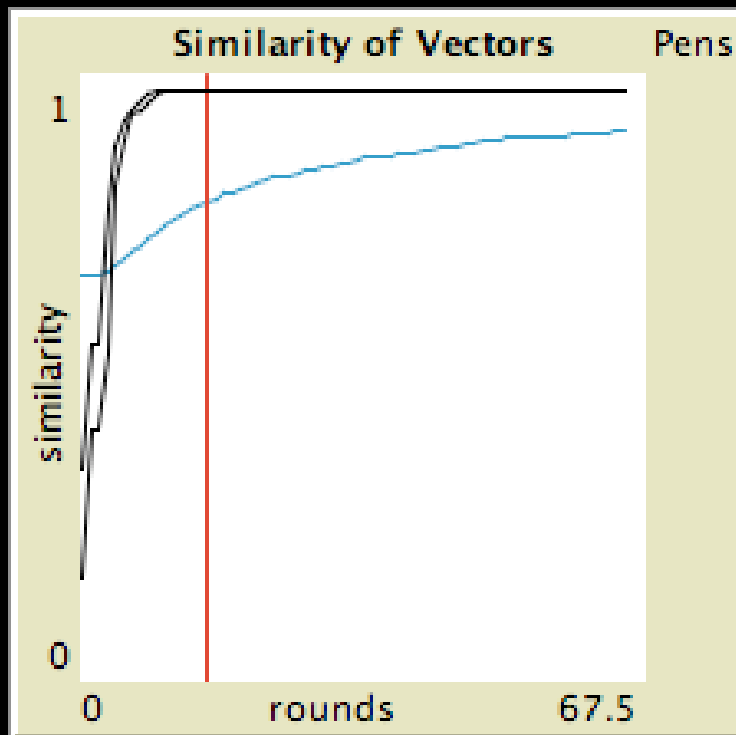


earnings



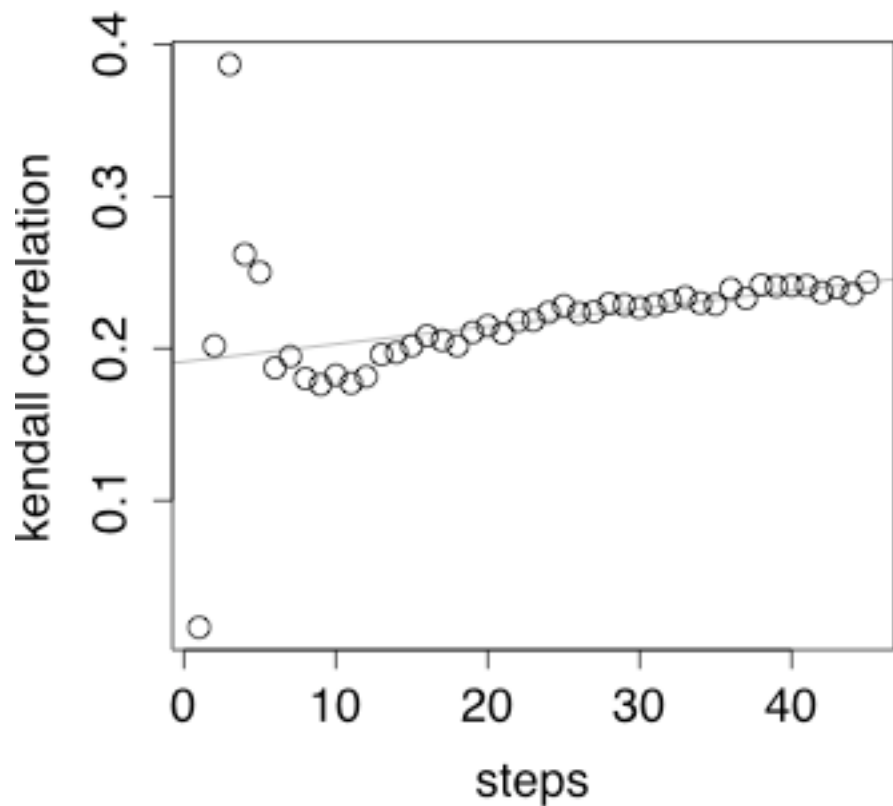
payout

Centrality

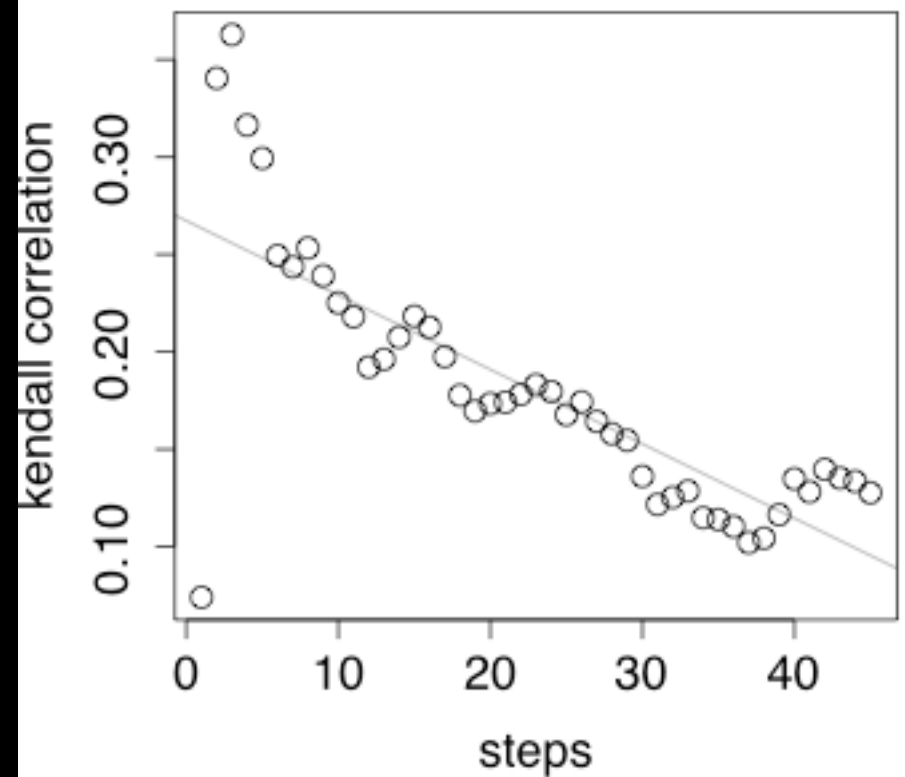


diameter 15

Centrality

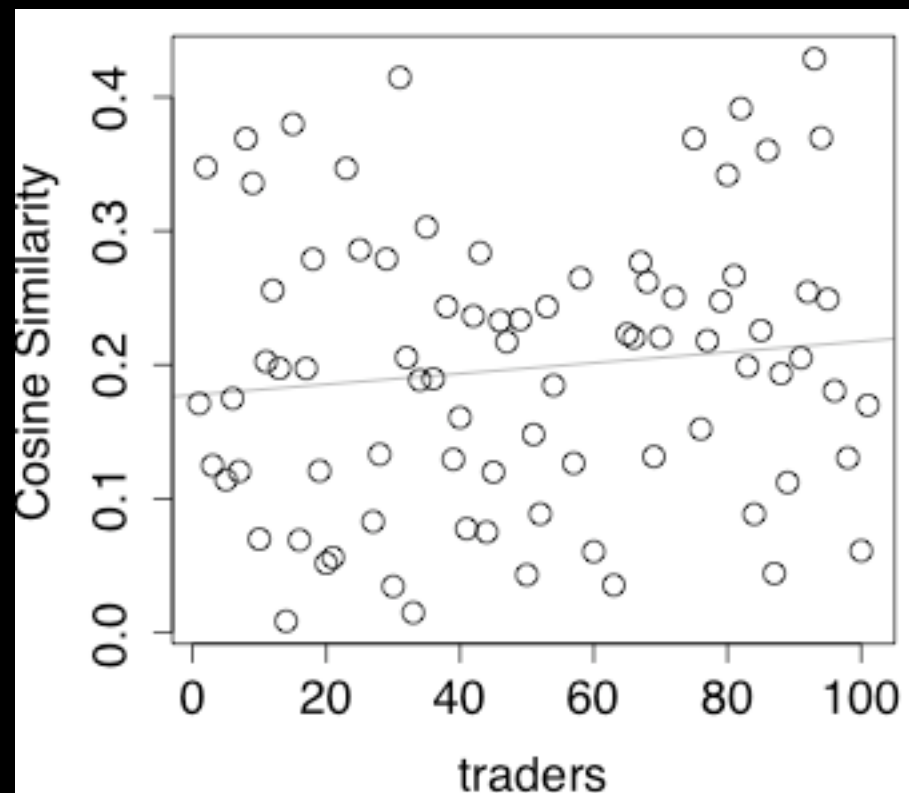


earnings

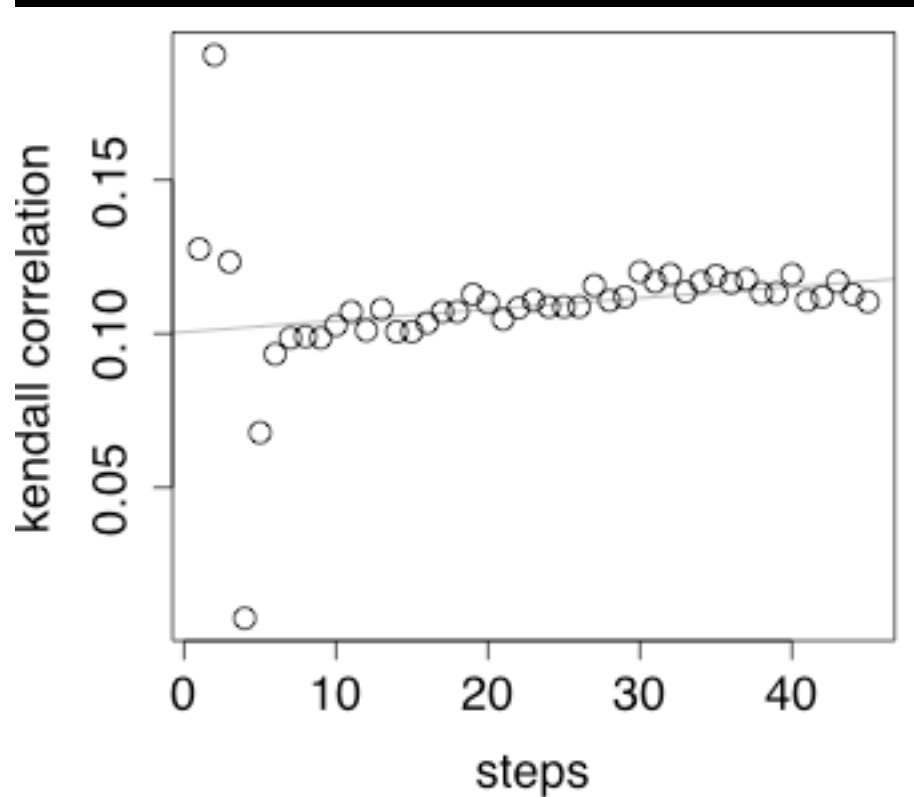


payout

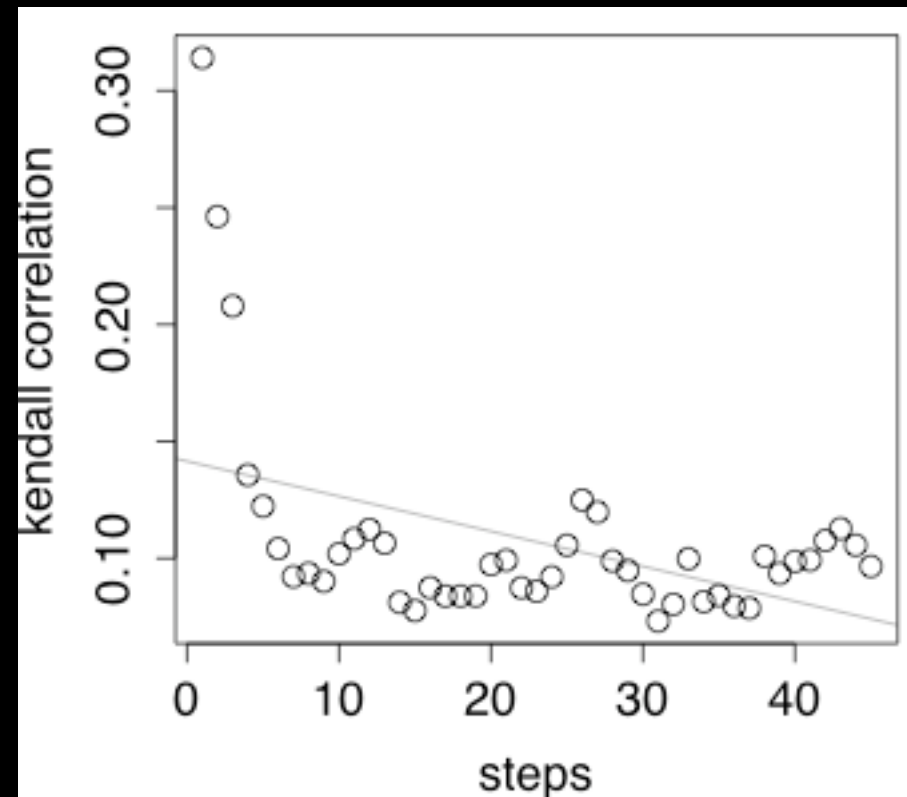
Original Information cosine similarity



Original information

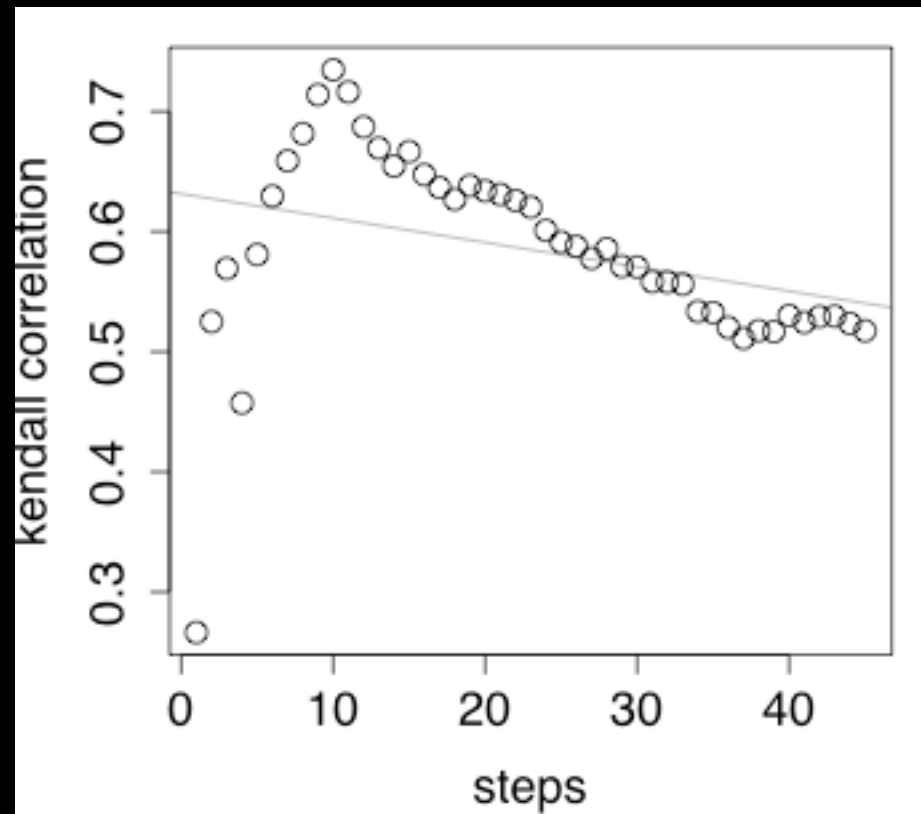


earnings



payout

Earnings & Payout



Conclusions

- Trade-order is not a predictor of success for few rounds and many contracts
- **Centrality** is a predictor of success for both types of winner
- Original information is not a predictor of success

Real Conclusion

The information traders use as it is revealed through time is an important factor in understanding and thus exploiting the predictive power of prediction markets

Thank You