

# Voting, Success, and Superstars

Principles of Complex Systems | @pocsvox  
 CSYS/MATH 300, Fall, 2016 | #FallPoCS2016

Prof. Peter Dodds | @peterdodds

Dept. of Mathematics & Statistics | Vermont Complex Systems Center  
 Vermont Advanced Computing Core | University of Vermont



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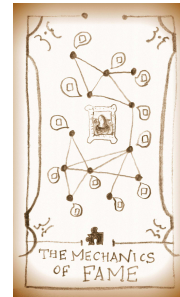
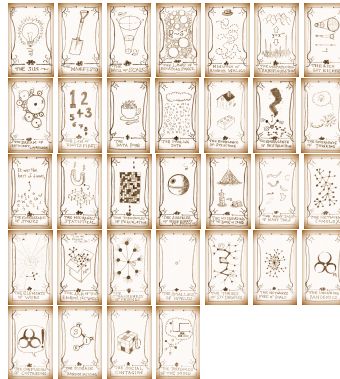
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Where do superstars come from?



"The economics of superstars" [↗](#)  
 S. Rosen,  
 Am. Econ. Rev., 71, 845–858, 1981. [5]

Examples:

- 🧩 Full-time Comedians ( $\approx 200$ )
- 🧩 Soloists in Classical Music
- 🧩 Economic Textbooks (the usual myopic example)
- 🧩 Highly skewed distributions again...

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Superstars

Rosen's theory:

- 🧩 Individual quality  $q$  maps to reward  $R(q)$ .
- 🧩  $R(q)$  is 'convex' ( $d^2 R/dq^2 > 0$ ).
- 🧩 Two reasons:
  1. **Imperfect substitution:**  
A very good surgeon is worth many mediocre ones
  2. **Technology:**  
Media spreads & technology reduces cost of reproduction of books, songs, etc.
- 🧩 Joint consumption versus public good.
- 🧩 No social element—success follows 'inherent quality'.

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# Superstars



"Stardom and Talent"  
 Moshe Adler,  
 American Economic Review, **75**, 208-212,  
 1985. [1]

- "Consumption capital": "Appreciation [of music] increases with knowledge. But how does one know about music? By listening to it, *and discussing it with other persons who know about it.*"
- Assumes extreme case of equal 'inherent quality'
- Argues desire for coordination in knowledge and culture leads to differential success
- Success can be purely a social construction
- (How can we measure 'inherent quality?')

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# Voting



"Aggregating partial, local evaluations to  
 achieve global ranking"  
 Laureti, Moret, and Zhang,  
 Physica A, **345**, 705-712, 2004. [4]

- Model: participants rank  $n$  objects based on underlying quality  $q$
- Assume evaluation of object  $i$  is a random variable with mean  $q_i$
- Choose objects based on votes:

$$p_i(t) \propto v_i(t)^\alpha \text{ or } p_i(t) \propto q_i v_i(t)^\alpha.$$

- If  $\alpha < 1$ , correct quality ordering is uncovered
- If  $\alpha > 1$ , some objects are never evaluated and mistakes are made...
- Related to Adler's approach

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# Voting

Evidence from the web suggestions (Huberman et al.)

1. Easy decisions (yes/no) lead to bandwagoning  
 e.g. jyte.com
2. More costly evaluations lead to oppositional votes  
 e.g. amazon.com

- **Self-selection:** Costly voting may lower incentives for those who agree with the current assessment and increase incentives for those who disagree.

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# Dominance hierarchies



"Individual differences versus social dynamics  
 in the formation of animal dominance  
 hierarchies"  
 Chase et al.,  
 Proc. Natl. Acad. Sci., **99**, 5744-5749, 2002. [3]

- The aggressive female *Metriaclicma zebra*:



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# Voting

Score-based voting versus rank-based voting:



"A theory of measuring, electing, and  
 ranking"  
 Balinski and Laraki,  
 Proc. Natl. Acad. Sci., **104**, 8720-8725,  
 2007. [2]

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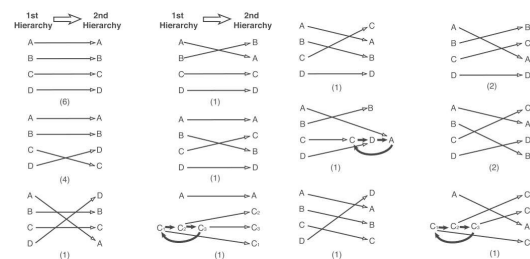


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# Dominance hierarchies

- Pecking orders for fish...

Fish forget—changing of dominance hierarchies:



- 22 observations: about 3/4 of the time, hierarchy changed

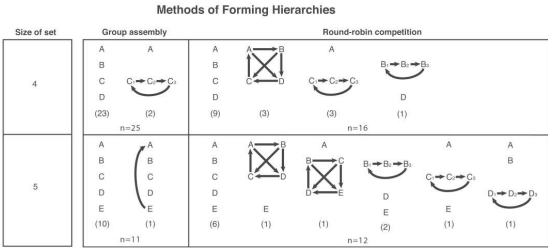
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# Dominance hierarchies



Group versus isolated interactions produce different hierarchies

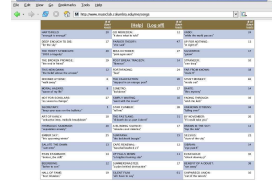


# Music Lab Experiment

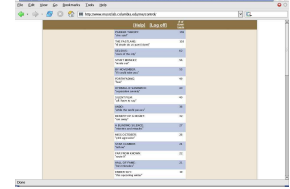
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## Experiment 1



## Experiments 2-4



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# Music Lab Experiment



48 songs  
30,000 participants

BAND NAME	(title)	(Log off)	# of total downloads
INDISTINCT PEOPLE	Indistinct	100%	86
INDISTINCT PEOPLE	Indistinct	100%	62
INDISTINCT PEOPLE	Indistinct	100%	45

multiple 'worlds'  
Inter-world variability

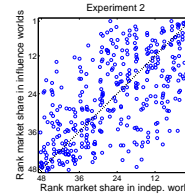
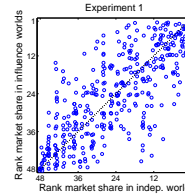
- How probable is the world?
- Can we estimate variability?
- Superstars dominate but are unpredictable. Why?



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Variability in final rank.



# Music Lab Experiment

Rank	Download	Superstars	(title)	(Log off)	# of total downloads
1	100%	100%	Indistinct	100%	86
2	100%	100%	Indistinct	100%	62
3	100%	100%	Indistinct	100%	45
4	100%	100%	Indistinct	100%	31
5	100%	100%	Indistinct	100%	27
6	100%	100%	Indistinct	100%	23
7	100%	100%	Indistinct	100%	19
8	100%	100%	Indistinct	100%	15
9	100%	100%	Indistinct	100%	11
10	100%	100%	Indistinct	100%	7
11	100%	100%	Indistinct	100%	3
12	100%	100%	Indistinct	100%	3
13	100%	100%	Indistinct	100%	3
14	100%	100%	Indistinct	100%	3
15	100%	100%	Indistinct	100%	3
16	100%	100%	Indistinct	100%	3
17	100%	100%	Indistinct	100%	3
18	100%	100%	Indistinct	100%	3
19	100%	100%	Indistinct	100%	3
20	100%	100%	Indistinct	100%	3
21	100%	100%	Indistinct	100%	3
22	100%	100%	Indistinct	100%	3
23	100%	100%	Indistinct	100%	3
24	100%	100%	Indistinct	100%	3
25	100%	100%	Indistinct	100%	3
26	100%	100%	Indistinct	100%	3
27	100%	100%	Indistinct	100%	3
28	100%	100%	Indistinct	100%	3
29	100%	100%	Indistinct	100%	3
30	100%	100%	Indistinct	100%	3
31	100%	100%	Indistinct	100%	3
32	100%	100%	Indistinct	100%	3
33	100%	100%	Indistinct	100%	3
34	100%	100%	Indistinct	100%	3
35	100%	100%	Indistinct	100%	3
36	100%	100%	Indistinct	100%	3
37	100%	100%	Indistinct	100%	3
38	100%	100%	Indistinct	100%	3
39	100%	100%	Indistinct	100%	3
40	100%	100%	Indistinct	100%	3
41	100%	100%	Indistinct	100%	3
42	100%	100%	Indistinct	100%	3
43	100%	100%	Indistinct	100%	3
44	100%	100%	Indistinct	100%	3
45	100%	100%	Indistinct	100%	3
46	100%	100%	Indistinct	100%	3
47	100%	100%	Indistinct	100%	3
48	100%	100%	Indistinct	100%	3



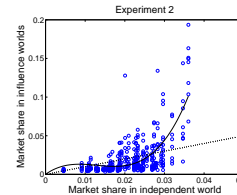
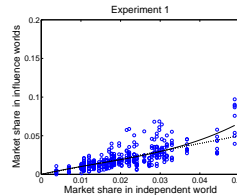
"An experimental study of inequality and unpredictability in an artificial cultural market"  
Salganik, Dodds, and Watts, Science, 311, 854-856, 2006. [6]



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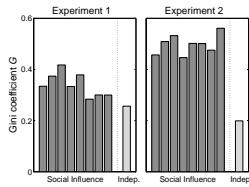
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Variability in final number of downloads.



## Music Lab Experiment



🔗 Inequality as measured by Gini coefficient:

$$G = \frac{1}{(2N_s - 1)} \sum_{i=1}^{N_s} \sum_{j=1}^{N_s} |m_i - m_j|$$

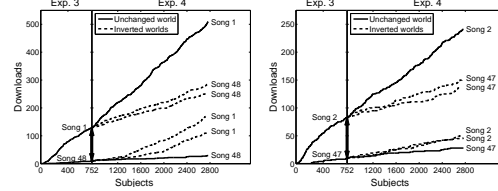
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## Music Lab Experiment—Sneakiness [7]



🔗 Inversion of download count  
🔗 The pretend rich get richer ...  
🔗 ... but at a slower rate

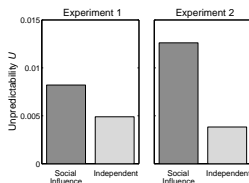
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## Music Lab Experiment



🔗 Unpredictability

$$U = \frac{1}{N_s \binom{N_w}{2}} \sum_{i=1}^{N_s} \sum_{j=1}^{N_w} \sum_{k=j+1}^{N_w} |m_{i,j} - m_{i,k}|$$

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## Music Lab Experiment

Sensible result:

🔗 Stronger social signal leads to **greater following** and **greater inequality**.

Peculiar result:

🔗 Stronger social signal leads to greater **unpredictability**.

Very peculiar observation:

🔗 The most unequal distributions would suggest the greatest variation in underlying 'quality.'

🔗 But success may be due to social construction through **following**. (so let's tell a story... [8, 9])

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