

Voting, Success, and Superstars

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Principles of Complex Systems, Vols. 1, 2, & 3D
CSYS/MATH 6701, 6713, & a pretend number,
2023–2024 | @pocsvox

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Santa Fe Institute | University of Vermont



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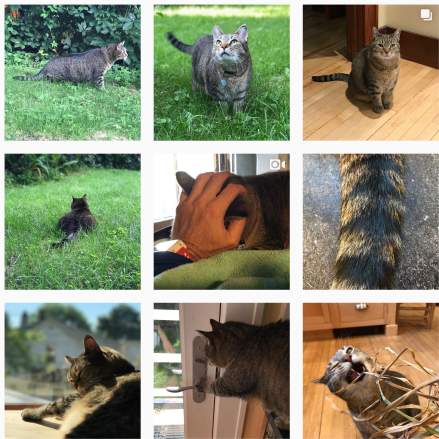
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Outline

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Where do superstars come from?


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"The economics of superstars" 

S. Rosen,

Am. Econ. Rev., **71**, 845–858, 1981. [5]

Examples:

-  Full-time Comedians (≈ 200)
-  Soloists in Classical Music
-  Economic Textbooks (the usual myopic example)

-  Highly skewed distributions again...



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'.





"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'?)





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.



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]





"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



Dominance hierarchies

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“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 *Metriaclima zebra*:



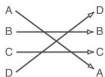
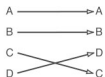
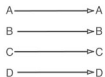
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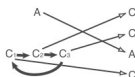
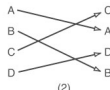
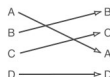
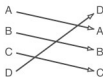
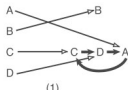
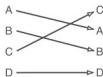
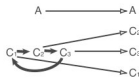
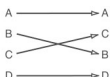
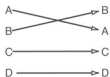
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Fish forget—changing of dominance hierarchies:

1st Hierarchy \rightleftharpoons 2nd Hierarchy



1st Hierarchy \rightleftharpoons 2nd Hierarchy



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



Dominance hierarchies

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Methods of Forming Hierarchies	
Size of set	Group assembly Round-robin competition
4	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>A A</p> <p>B</p> <p>C C₁ → C₂ → C₃</p> <p>D</p> <p>(23) (2)</p> <p>n=25</p> </div> <div style="text-align: center;"> <p>A A → B</p> <p>B B → A</p> <p>C C → D</p> <p>D D → C</p> <p>(9) (3)</p> </div> <div style="text-align: center;"> <p>A A</p> <p>B B₁ → B₂ → B₃</p> <p>C C₁ → C₂ → C₃</p> <p>D</p> <p>(3) (1)</p> <p>n=16</p> </div> </div>
5	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>A A</p> <p>B B</p> <p>C C</p> <p>D D</p> <p>E E</p> <p>(10) (1)</p> <p>n=11</p> </div> <div style="text-align: center;"> <p>A A → B</p> <p>B B → A</p> <p>C C → D</p> <p>D D → C</p> <p>E</p> <p>(6) (1)</p> </div> <div style="text-align: center;"> <p>A A</p> <p>B B → C</p> <p>C C → B</p> <p>D D → E</p> <p>E E → D</p> <p>(1) (1)</p> </div> <div style="text-align: center;"> <p>B₁ → B₂ → B₃</p> <p>D</p> <p>E</p> <p>(2)</p> </div> <div style="text-align: center;"> <p>A A</p> <p>B</p> <p>C C₁ → C₂ → C₃</p> <p>E</p> <p>(1)</p> </div> <div style="text-align: center;"> <p>A A</p> <p>B</p> <p>D₁ → D₂ → D₃</p> <p>(1)</p> </div> </div> <p style="text-align: center;">n=12</p>



Group versus isolated interactions produce different hierarchies



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[Help]	[Log off]	# of down loads
GROWTH PEOPLE: "names"		86
ACCEPT THAT: "the people"		52
LISTFORPEOPLE: "no way out"		45

BAND NAME

SONG TITLE

NUMBER OF DOWNLOADS

48 songs

30,000 participants

multiple 'worlds'

Inter-world variability

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



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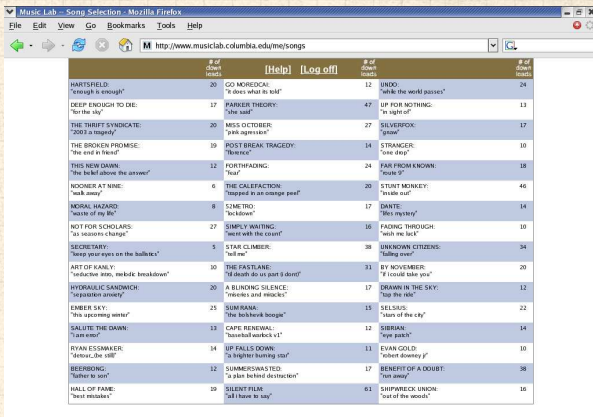
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	# of down loads	[Help] [Log off]	# of down loads	# of down loads	
HARTSFIELD: "enough is enough"	20	GO MORECOCAL: "is does what its told"	12	UNDO: "while the world passes"	24
DEEP ENOUGH TO DIE: "for the sky"	17	PARKER THEORY: "she said"	47	UP FOR NOTHING: "in sight of"	13
THE THRIFT SYNDICATE: "2003 a tragedy"	20	MESS OCTOBER: "pink aggression"	27	SILVERFOX: "glow"	17
THE BROKEN PROMISE: "the end in hand"	19	POST BREAK TRAGEDY: "silence"	14	STRANGER: "one step"	10
THIS NEW DAWN: "the helix above the answer"	12	FORTHFADING: "leaf"	24	FAR FROM KNOWN: "outsie?"	18
HOOMER AT NINE: "walk away"	6	THE CALEFACTION: "trapped in an orange peel"	20	STUNT MONKEY: "inside out"	46
MORAL HAZARD: "waste of my life"	8	SIMETRO: "lockdown"	17	DANTE: "Bles mystery"	14
NOT FOR SCHOLARS: "as seasons change"	27	SIMPLY WAITING: "meet with the count"	16	FADING THROUGH: "wish me luck"	10
SECRETARY: "three post-its on the bulletin"	5	STAR CLIMBER: "hell no"	38	UNKNOWN CITIZENS: "falling over"	34
ART OF KAMLY: "reductive 400, melodic breakdown"	10	THE FACTLANE: "if death do us part 9 dont"	31	BY NOVEMBER: "if i could take you"	20
HYDRAULIC SANDWICH: "separation anxiety"	20	A BLINDING SILENCE: "pieces and pieces"	17	DRAWN IN THE SKY: "top the ride"	12
EMBER SKY: "this upcoming winter"	25	SUMRAMA: "the bobbeik boogie"	15	SELSAUS: "stars of the city"	22
SALUTE THE DAWN: "i am emor"	13	CAPE RENEWAL: "baseball workout v1"	12	SIBRIAN: "eye patch"	14
RYAN ESSMAKER: "demon, the still"	14	UP FALLS DOWN: "a bright burning star"	11	EVAN GOLD: "what doremy j"	10
BEESBONG: "father to son"	12	SUMMERSWASTED: "a plan behind destruction"	17	BENEFIT OF A DOUBT: "run away"	38
HALL OF FAME: "best mistakes"	19	SILENT FILM: "all i have to say"	61	SHIPWRECK UNKON: "out of the woods"	16

"An experimental study of inequality and unpredictability in an artificial cultural market" 

Salganik, Dodds, and Watts,
Science, **311**, 854-856, 2006. ^[6]



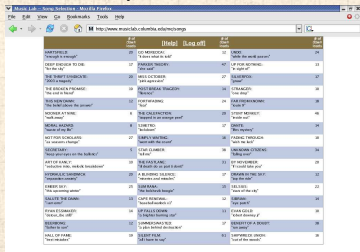
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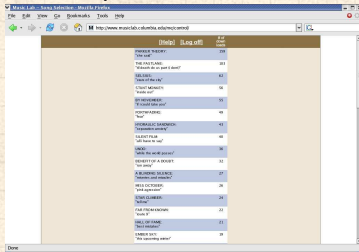
References

Experiment 1



Rank	Song Title	P.C. Rank
1	WINTERFELDS Through a Glimpse	24
2	CEMPERSON I have come to you!	24
3	DEEP BREATH TO DIE The Way	33
4	THE SHARP SPOONERS SPOONERS	37
5	WELL OCTOBER 10th Anniversary	27
6	THE SHINY & PINKIE THE SHINY	34
7	NOVEMBER 19th The 10th Anniversary	38
8	NOVEMBER 19th The 10th Anniversary	38
9	NOVEMBER 19th The 10th Anniversary	38
10	NOVEMBER 19th The 10th Anniversary	38
11	NOVEMBER 19th The 10th Anniversary	38
12	NOVEMBER 19th The 10th Anniversary	38
13	NOVEMBER 19th The 10th Anniversary	38
14	NOVEMBER 19th The 10th Anniversary	38
15	NOVEMBER 19th The 10th Anniversary	38
16	NOVEMBER 19th The 10th Anniversary	38
17	NOVEMBER 19th The 10th Anniversary	38
18	NOVEMBER 19th The 10th Anniversary	38
19	NOVEMBER 19th The 10th Anniversary	38
20	NOVEMBER 19th The 10th Anniversary	38
21	NOVEMBER 19th The 10th Anniversary	38
22	NOVEMBER 19th The 10th Anniversary	38
23	NOVEMBER 19th The 10th Anniversary	38
24	NOVEMBER 19th The 10th Anniversary	38
25	NOVEMBER 19th The 10th Anniversary	38
26	NOVEMBER 19th The 10th Anniversary	38
27	NOVEMBER 19th The 10th Anniversary	38
28	NOVEMBER 19th The 10th Anniversary	38

Experiments 2-4



Rank	Song Title	P.C. Rank
1	WINTERFELDS Through a Glimpse	24
2	CEMPERSON I have come to you!	24
3	DEEP BREATH TO DIE The Way	33
4	THE SHARP SPOONERS SPOONERS	37
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13	NOVEMBER 19th The 10th Anniversary	38
14	NOVEMBER 19th The 10th Anniversary	38
15	NOVEMBER 19th The 10th Anniversary	38
16	NOVEMBER 19th The 10th Anniversary	38
17	NOVEMBER 19th The 10th Anniversary	38
18	NOVEMBER 19th The 10th Anniversary	38
19	NOVEMBER 19th The 10th Anniversary	38
20	NOVEMBER 19th The 10th Anniversary	38
21	NOVEMBER 19th The 10th Anniversary	38
22	NOVEMBER 19th The 10th Anniversary	38
23	NOVEMBER 19th The 10th Anniversary	38
24	NOVEMBER 19th The 10th Anniversary	38
25	NOVEMBER 19th The 10th Anniversary	38
26	NOVEMBER 19th The 10th Anniversary	38
27	NOVEMBER 19th The 10th Anniversary	38
28	NOVEMBER 19th The 10th Anniversary	38



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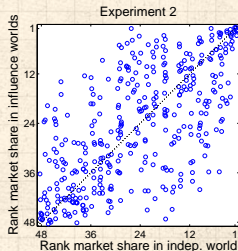
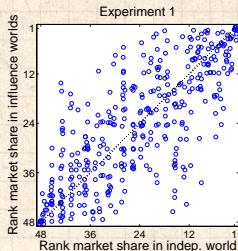
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Variability in final rank.



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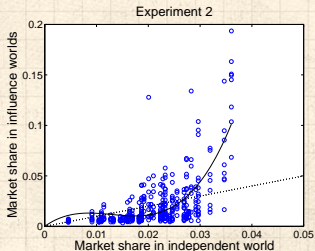
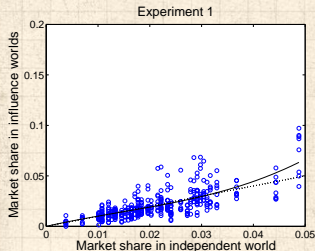
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Variability in final number of downloads.



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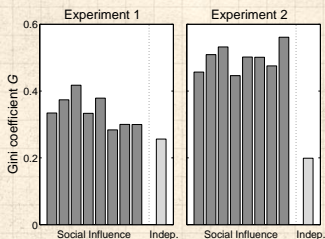
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Inequality as measured by Gini coefficient:

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



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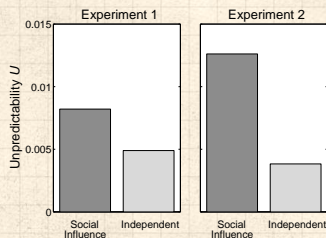
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Unpredictability

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



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Sensible result:

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

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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])



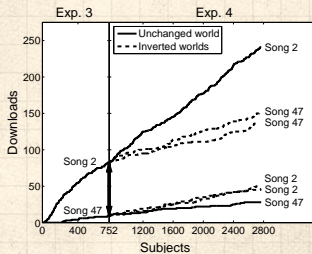
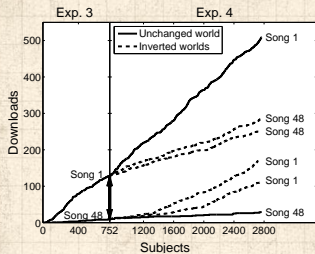
Music Lab Experiment—Sneakiness [7]

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






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[American Economic Review](#), pages 208–212, 1985.
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