

# Voting, Success, and Superstars


Last updated: 2024/11/11, 14:10:39 EST

Principles of Complex Systems, Vols. 1, 2, & 3D  
CSYS/MATH 6701, 6713, & a pretend number, 2024–2025

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Santa Fe Institute | University of Vermont



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everyone

Superstars

Musicalab

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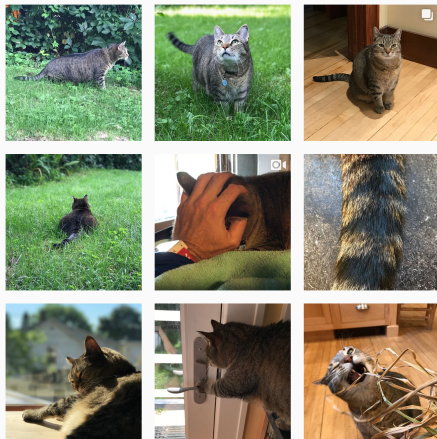
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# Outline

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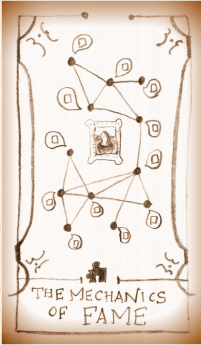
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# Where do superstars come from?


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“The economics of superstars” 

S. Rosen,

Am. Econ. Rev., **71**, 845–858, 1981. <sup>[5]</sup>

Examples:



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Examples:

 Full-time Comedians ( $\approx 200$ )





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## Examples:

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Economic Textbooks (the usual myopic example)



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## Examples:

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



# Superstars


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Rosen's theory:

 Individual quality  $q$  maps to reward  $R(q)$ .



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Rosen's theory:

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# Superstars

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2. **Technology:**


Media spreads & technology reduces cost of reproduction of books, songs, etc.




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 Joint consumption versus public good.



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- 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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## “Stardom and Talent”

Moshe Adler,

American Economic Review, **75**, 208–212, 1985. <sup>[1]</sup>



“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.*”





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 Argues desire for coordination in knowledge and culture leads to differential success











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-  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








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 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.




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References

## 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. <sup>[2]</sup>





“Aggregating partial, local evaluations to achieve global ranking” 


Laureti, Moret, and Zhang,  
Physica A, **345**, 705–712, 2004. <sup>[4]</sup>





Model: participants rank  $n$  objects based on underlying quality  $q$






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-  If  $\alpha > 1$ , some objects are never evaluated and mistakes are made...








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-  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 *Metriacrima* zebra:



🧱 Pecking orders for fish...

# Dominance hierarchies

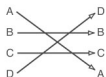
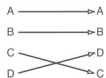
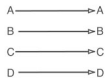
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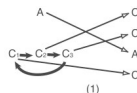
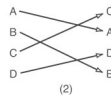
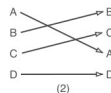
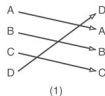
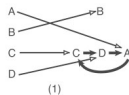
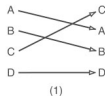
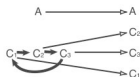
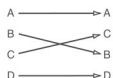
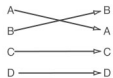
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## Fish forget—changing of dominance hierarchies:

1st Hierarchy  $\Rightarrow$  2nd Hierarchy



1st Hierarchy  $\Rightarrow$  2nd Hierarchy



# Dominance hierarchies

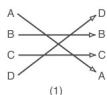
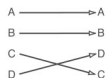
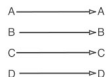
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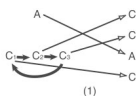
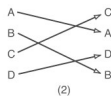
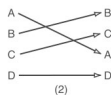
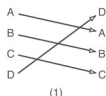
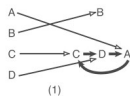
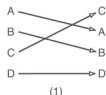
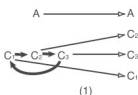
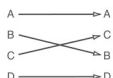
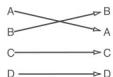
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1st Hierarchy  $\Rightarrow$  2nd Hierarchy



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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	<p>A A</p> <p>B</p> <p>C <math>C_1 \rightarrow C_2 \rightarrow C_3</math></p> <p>D</p> <p>(23) (2)</p> <p>n=25</p>	<p>A <math>A \rightarrow B</math></p> <p>B <math>A \rightarrow B</math></p> <p>C <math>C \rightarrow D</math></p> <p>D <math>C \rightarrow D</math></p> <p>(9) (3)</p>	<p>A</p> <p><math>C_1 \rightarrow C_2 \rightarrow C_3</math></p> <p>(3)</p> <p>n=16</p>	<p><math>B_1 \rightarrow B_2 \rightarrow B_3</math></p> <p>D</p> <p>(1)</p>	
5	<p>A</p> <p>B <math>A \rightarrow B</math></p> <p>C <math>A \rightarrow B</math></p> <p>D <math>A \rightarrow B</math></p> <p>E <math>A \rightarrow B</math></p> <p>(10) (1)</p> <p>n=11</p>	<p>A <math>A \rightarrow B</math></p> <p>B <math>A \rightarrow B</math></p> <p>C <math>C \rightarrow D</math></p> <p>D <math>C \rightarrow D</math></p> <p>E</p> <p>(6) (1)</p>	<p>A</p> <p><math>B \rightarrow C</math></p> <p><math>B \rightarrow C</math></p> <p>D <math>B \rightarrow C</math></p> <p>E <math>B \rightarrow C</math></p> <p>(1) (1)</p> <p>n=12</p>	<p><math>B_1 \rightarrow B_2 \rightarrow B_3</math></p> <p>D</p> <p>E</p> <p>(2)</p>	<p>A <math>C_1 \rightarrow C_2 \rightarrow C_3</math></p> <p>B</p> <p><math>D_1 \rightarrow D_2 \rightarrow D_3</math></p> <p>E</p> <p>(1) (1)</p>



Group versus isolated interactions produce different hierarchies



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# Music Lab Experiment



48 songs  
30,000 participants

**BAND NAME**

**SONG TITLE**

**NUMBER OF DOWNLOADS**

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

multiple 'worlds'  
Inter-world variability

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 Can we estimate variability?

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Inter-world variability



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*BAND NAME* (red arrow pointing to GROWTH PEOPLE)


*SONG TITLE* (red arrow pointing to "names")


*NUMBER OF DOWNLOADS* (red arrow pointing to 45)

48 songs

30,000 participants

 How probable is the world?

 Can we estimate variability?

 Superstars dominate but are unpredictable. Why?

multiple 'worlds'

Inter-world variability



# Music Lab Experiment

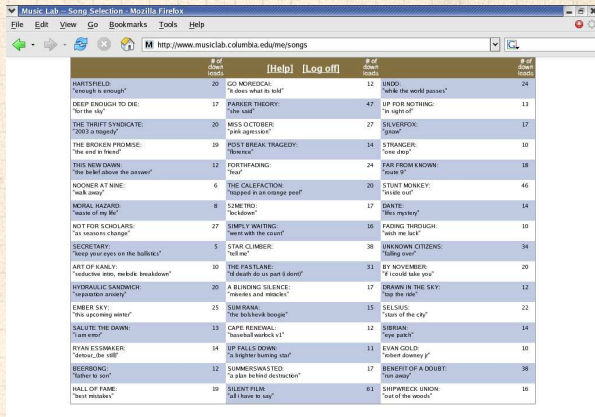
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	# of down loads	[Help] [Log off]	# of down loads		
HARTSFIELD: "enough is enough"	20	GO MOREDECA: "it does what it told"	12	UNDO: "while the world passes"	24
DEEP ENOUGH TO DIE: "for the sky"	17	PARKER THEORY: "the sad"	47	UP FOR NOTHING: "in sight of"	13
THE THRIFT SYNDICATE: "2009 a tragedy"	20	MISS OCTOBER: "my expression"	27	SILVERFOX: "glide"	17
THE BROKEN PROMISE: "the end is here"	19	POST BREAK TRAGEDY: "horror"	14	STRANGER: "one step"	10
THIS NEW DAWN: "the belief above the answer"	12	FORTHFACING: "leaf"	24	FAR FROM KNOWN: "noise 9"	18
NOONER 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	SZMETRO: "lockdown"	17	DANTE: "his mystery"	14
NOT FOR SCHOLARS: "six seasons change"	27	SIMPLY WAITING: "smoke with the count"	16	FACING THROUGH: "with me left"	10
SECRETARY: "keep your eyes on the ballistics"	5	STAR CLIMBER: "hell no"	38	UNKNOWN CITIZENS: "talking over"	34
ART OF KAMELY: "seductive into, melodic breakdown"	10	THE FASTLANE: "if death do us part i don't"	31	BY NOVEMBER: "if i could take you"	20
HYDRAULIC SANDWICH: "separation anxiety"	20	A BLINDING SILENCE: "riddles and riddles"	17	DRAWN IN THE SKY: "tap the ride"	12
EMBER SKY: "his upcoming winter"	25	SUM RANA: "the bobbeek boogie"	15	SELSAUS: "stars of the city"	22
SALUTE THE DAWN: "i am one"	13	CAPE RENEWAL: "hassled workday v1"	12	SIBIRIAN: "spin park"	14
RYAN ESSMAKER: "detour, be still"	14	UP FALLS DOWN: "a brighter burning star"	11	EVAN GOLD: "robert downey jr"	10
BEERBORG: "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 UNION: "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. <sup>[6]</sup>



# Music Lab Experiment

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## Experiment 1

Rank	Artist	Album	Score
1	ANTHONY & DAVID	"I'm a Maniac!"	24
2	CHER	"I've Got a Crush on You"	23
3	CHER	"I've Got a Crush on You"	23
4	CHER	"I've Got a Crush on You"	23
5	CHER	"I've Got a Crush on You"	23
6	CHER	"I've Got a Crush on You"	23
7	CHER	"I've Got a Crush on You"	23
8	CHER	"I've Got a Crush on You"	23
9	CHER	"I've Got a Crush on You"	23
10	CHER	"I've Got a Crush on You"	23
11	CHER	"I've Got a Crush on You"	23
12	CHER	"I've Got a Crush on You"	23
13	CHER	"I've Got a Crush on You"	23
14	CHER	"I've Got a Crush on You"	23
15	CHER	"I've Got a Crush on You"	23
16	CHER	"I've Got a Crush on You"	23
17	CHER	"I've Got a Crush on You"	23
18	CHER	"I've Got a Crush on You"	23
19	CHER	"I've Got a Crush on You"	23
20	CHER	"I've Got a Crush on You"	23

## Experiments 2-4

Rank	Artist	Album	Score
1	ANTHONY & DAVID	"I'm a Maniac!"	24
2	CHER	"I've Got a Crush on You"	23
3	CHER	"I've Got a Crush on You"	23
4	CHER	"I've Got a Crush on You"	23
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6	CHER	"I've Got a Crush on You"	23
7	CHER	"I've Got a Crush on You"	23
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16	CHER	"I've Got a Crush on You"	23
17	CHER	"I've Got a Crush on You"	23
18	CHER	"I've Got a Crush on You"	23
19	CHER	"I've Got a Crush on You"	23
20	CHER	"I've Got a Crush on You"	23



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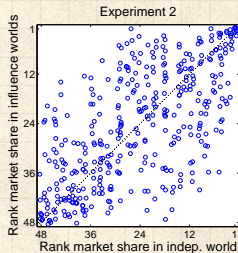
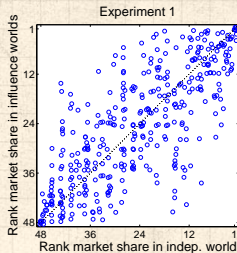
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Variability in final rank.



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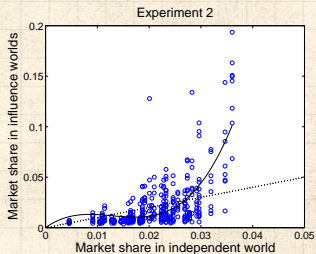
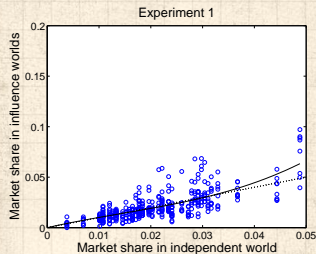
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Variability in final number of downloads.



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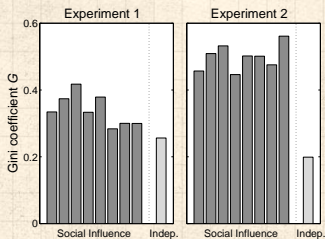
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Inequality as measured by Gini coefficient:

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





# Music Lab Experiment

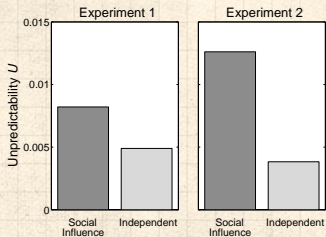
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## Unpredictability

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



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Sensible result:

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



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Peculiar result:



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Very peculiar observation:



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# Music Lab Experiment

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# Music Lab Experiment

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## 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]

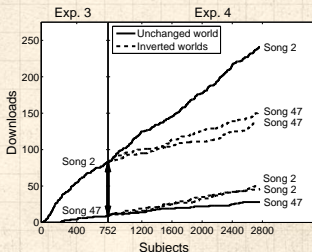
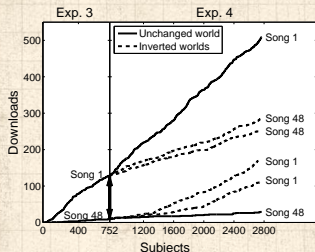
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# Music Lab Experiment—Sneakiness [7]

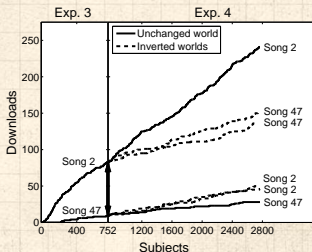
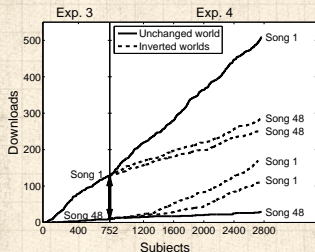
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The pretend rich get richer ...



# Music Lab Experiment—Sneakiness [7]

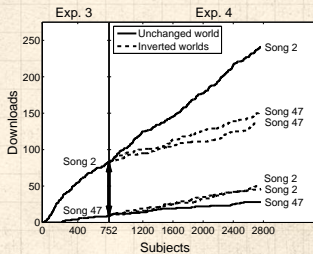
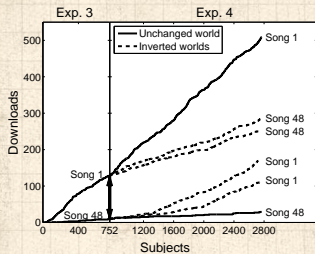
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🧱 Inversion of download count

🧱 The pretend rich get richer ...

🧱 ... but at a slower rate






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