

# Voting, Success, and Superstars

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Principles of Complex Systems, Vols. 1 & 2  
CSYS/MATH 300 and 303, 2021-2022 | @pocsvox

The PoCSverse  
Voting, Success,  
and Superstars  
1 of 28

Winning: it's not  
for everyone

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References

Prof. Peter Sheridan Dodds | @peterdodds

Computational Story Lab | Vermont Complex Systems Center  
Vermont Advanced Computing Core | University of Vermont



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Voting, Success,  
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2 of 28

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for everyone  
Superstars  
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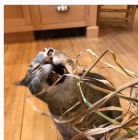
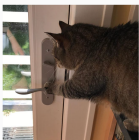
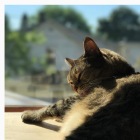
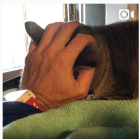
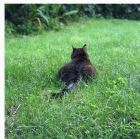
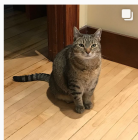
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and Superstars  
3 of 28

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for everyone

Superstars  
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 On Instagram at [pratchett\\_the\\_cat](https://www.instagram.com/pratchett_the_cat) 

# Outline

The PoCSverse  
Voting, Success,  
and Superstars  
4 of 28

Winning: it's not  
for everyone

Superstars  
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References

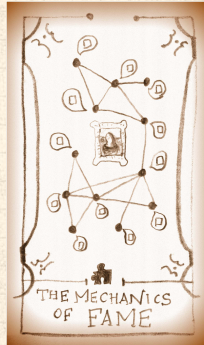
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Superstars

Musiclab

References





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The PoCverse  
Voting, Success,  
and Superstars  
6 of 28

Winning: it's not  
for everyone

Superstars  
Musiclab

References

Winning: it's not for everyone

Superstars

Musiclab

References





# Where do superstars come from?

The PoCSverse  
Voting, Success,  
and Superstars  
7 of 28

Winning: it's not  
for everyone

Superstars  
Musicalab

References



"The economics of superstars" 

S. Rosen,

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

Examples:



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The PoCSverse  
Voting, Success,  
and Superstars  
7 of 28

Winning: it's not  
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Superstars  
Musiclab

References




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Examples:

 Full-time Comedians ( $\approx 200$ )



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The PoCSverse  
Voting, Success,  
and Superstars  
7 of 28

Winning: it's not  
for everyone

Superstars  
Musicalab

References





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The PoCSverse  
Voting, Success,  
and Superstars  
7 of 28

Winning: it's not  
for everyone

Superstars  
Musicalab

References






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## Examples:

-  Full-time Comedians ( $\approx 200$ )
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-  Economic Textbooks (the usual myopic example)





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The PoCSverse  
Voting, Success,  
and Superstars  
7 of 28

Winning: it's not  
for everyone

Superstars  
Musicalab

References






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The PoCSverse  
Voting, Success,  
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7 of 28

Winning: it's not  
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Superstars  
Musicalab

References







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## Examples:

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



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and Superstars  
8 of 28

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for everyone

Superstars  
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References

Rosen's theory:

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



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The PoCVerse  
Voting, Success,  
and Superstars  
8 of 28

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for everyone

Superstars  
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References

## Rosen's theory:

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

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# Superstars




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A very good surgeon is worth many mediocre ones



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  2. **Technology:**





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



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Voting, Success,  
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8 of 28

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Superstars  
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  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'.



# Superstars



## "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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Voting, Success,  
and Superstars  
9 of 28

Winning: it's not  
for everyone

Superstars  
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References





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Assumes extreme case of equal 'inherent quality'










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





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-  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.





## 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  $q$





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- If  $\alpha > 1$ , some objects are never evaluated and mistakes are made...
- Related to Adler's approach



# Dominance hierarchies

The PoCSverse  
Voting, Success,  
and Superstars  
13 of 28

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References



“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*:



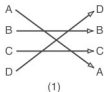
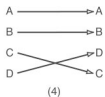
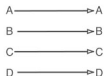
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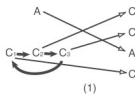
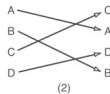
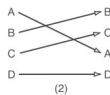
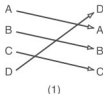
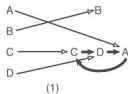
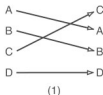
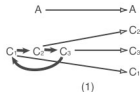
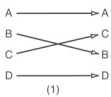
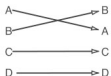
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## Fish forget—changing of dominance hierarchies:

1st Hierarchy  $\Rightarrow$  2nd Hierarchy



1st Hierarchy  $\Rightarrow$  2nd Hierarchy



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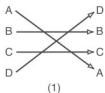
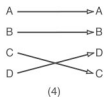
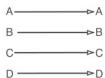
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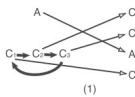
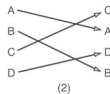
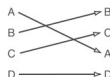
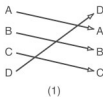
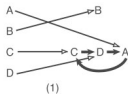
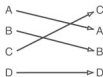
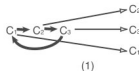
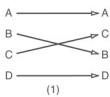
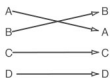
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1st Hierarchy  $\Rightarrow$  2nd Hierarchy



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



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The PoCverse  
Voting, Success,  
and Superstars  
15 of 28

Winning: it's not  
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Superstars  
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References

		Methods of Forming Hierarchies			
Size of set	Group assembly	Round-robin competition			
4	<p>A A</p> <p>B</p> <p>C C<sub>1</sub> → C<sub>2</sub> → C<sub>3</sub></p> <p>D</p> <p>(23) (2)</p> <p>n=25</p>	<p>A A → B</p> <p>B A → B</p> <p>C C → D</p> <p>D C → D</p> <p>(9) (3)</p>	<p>A</p> <p>C<sub>1</sub> → C<sub>2</sub> → C<sub>3</sub></p> <p>(3)</p>	<p>B<sub>1</sub> → B<sub>2</sub> → B<sub>3</sub></p> <p>D</p> <p>(1)</p> <p>n=16</p>	
5	<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>	<p>A A → B</p> <p>B A → B</p> <p>C C → D</p> <p>D C → D</p> <p>E</p> <p>(6) (1)</p>	<p>A</p> <p>B → C</p> <p>D → E</p> <p>(1) (1)</p>	<p>B<sub>1</sub> → B<sub>2</sub> → B<sub>3</sub></p> <p>D</p> <p>E</p> <p>(2) (1)</p>	<p>A A</p> <p>B B</p> <p>C<sub>1</sub> → C<sub>2</sub> → C<sub>3</sub></p> <p>E</p> <p>(1) (1)</p>



Group versus isolated interactions produce different hierarchies





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The PoCverse  
Voting, Success,  
and Superstars  
16 of 28

Winning: it's not  
for everyone

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References

Winning: it's not for everyone

Superstars

Musiclab

References



# Music Lab Experiment

The PoCVerse  
Voting, Success,  
and Superstars  
17 of 28

Winning: it's not  
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References



48 songs  
30,000 participants

**BAND NAME**

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

**SONG TITLE**

**NUMBER OF  
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multiple 'worlds'  
Inter-world variability



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Voting, Success,  
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17 of 28

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How probable is the world?



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How probable is the world?



Can we estimate variability?



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17 of 28

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Inter-world variability

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





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The PoCVerse  
Voting, Success,  
and Superstars  
18 of 28

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for everyone

Superstars

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

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

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



# Music Lab Experiment

The PoCVerse  
Voting, Success,  
and Superstars  
19 of 28

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## Experiment 1

Rank	Artist	Album	Year	Score
1	WINTERGUILD	Through a Veil	12	24
2	DEEP ECHOES TO DIE	The Way We	10	23
3	THE SHARP TONGUES	SHARP TONGUES	17	22
4	THE SHARP TONGUES	SHARP TONGUES	17	21
5	THE SHARP TONGUES	SHARP TONGUES	17	20
6	THE SHARP TONGUES	SHARP TONGUES	17	19
7	THE SHARP TONGUES	SHARP TONGUES	17	18
8	THE SHARP TONGUES	SHARP TONGUES	17	17
9	THE SHARP TONGUES	SHARP TONGUES	17	16
10	THE SHARP TONGUES	SHARP TONGUES	17	15
11	THE SHARP TONGUES	SHARP TONGUES	17	14
12	THE SHARP TONGUES	SHARP TONGUES	17	13
13	THE SHARP TONGUES	SHARP TONGUES	17	12
14	THE SHARP TONGUES	SHARP TONGUES	17	11
15	THE SHARP TONGUES	SHARP TONGUES	17	10
16	THE SHARP TONGUES	SHARP TONGUES	17	9
17	THE SHARP TONGUES	SHARP TONGUES	17	8
18	THE SHARP TONGUES	SHARP TONGUES	17	7
19	THE SHARP TONGUES	SHARP TONGUES	17	6
20	THE SHARP TONGUES	SHARP TONGUES	17	5
21	THE SHARP TONGUES	SHARP TONGUES	17	4
22	THE SHARP TONGUES	SHARP TONGUES	17	3
23	THE SHARP TONGUES	SHARP TONGUES	17	2
24	THE SHARP TONGUES	SHARP TONGUES	17	1

## Experiments 2-4

Rank	Artist	Album	Year	Score
1	WINTERGUILD	Through a Veil	12	24
2	DEEP ECHOES TO DIE	The Way We	10	23
3	THE SHARP TONGUES	SHARP TONGUES	17	22
4	THE SHARP TONGUES	SHARP TONGUES	17	21
5	THE SHARP TONGUES	SHARP TONGUES	17	20
6	THE SHARP TONGUES	SHARP TONGUES	17	19
7	THE SHARP TONGUES	SHARP TONGUES	17	18
8	THE SHARP TONGUES	SHARP TONGUES	17	17
9	THE SHARP TONGUES	SHARP TONGUES	17	16
10	THE SHARP TONGUES	SHARP TONGUES	17	15
11	THE SHARP TONGUES	SHARP TONGUES	17	14
12	THE SHARP TONGUES	SHARP TONGUES	17	13
13	THE SHARP TONGUES	SHARP TONGUES	17	12
14	THE SHARP TONGUES	SHARP TONGUES	17	11
15	THE SHARP TONGUES	SHARP TONGUES	17	10
16	THE SHARP TONGUES	SHARP TONGUES	17	9
17	THE SHARP TONGUES	SHARP TONGUES	17	8
18	THE SHARP TONGUES	SHARP TONGUES	17	7
19	THE SHARP TONGUES	SHARP TONGUES	17	6
20	THE SHARP TONGUES	SHARP TONGUES	17	5
21	THE SHARP TONGUES	SHARP TONGUES	17	4
22	THE SHARP TONGUES	SHARP TONGUES	17	3
23	THE SHARP TONGUES	SHARP TONGUES	17	2
24	THE SHARP TONGUES	SHARP TONGUES	17	1



# Music Lab Experiment

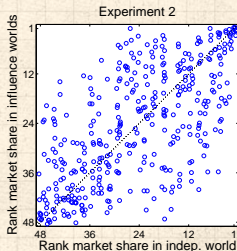
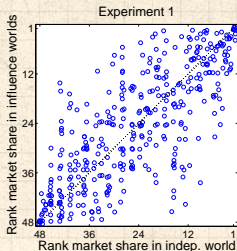
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Voting, Success,  
and Superstars  
20 of 28

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for everyone

Superstars

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Variability in final rank.



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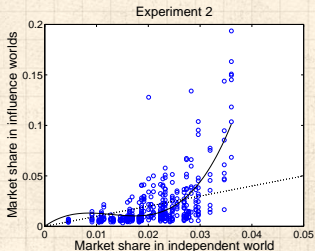
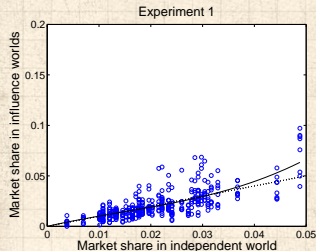
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and Superstars  
21 of 28

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for everyone

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Variability in final number of downloads.



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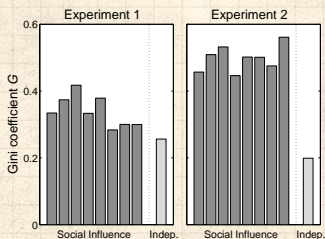
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Voting, Success,  
and Superstars  
22 of 28

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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

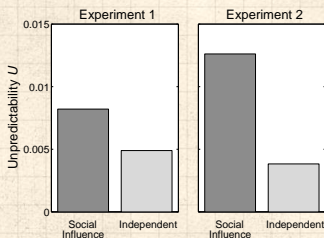
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Voting, Success,  
and Superstars  
23 of 28

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for everyone

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## Unpredictability

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



# Music Lab Experiment

Sensible result:

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

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Voting, Success,  
and Superstars  
24 of 28

Winning: it's not  
for everyone

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References



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The PoCSverse  
Voting, Success,  
and Superstars  
24 of 28

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for everyone

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Peculiar result:



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The PoCSverse  
Voting, Success,  
and Superstars  
24 of 28

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The PoCSverse  
Voting, Success,  
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24 of 28

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Very peculiar observation:






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The PoCSverse  
Voting, Success,  
and Superstars  
24 of 28

## Sensible result:

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## Peculiar result:

 Stronger social signal leads to greater  
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## Very peculiar observation:

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



# Music Lab Experiment

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Voting, Success,  
and Superstars  
24 of 28

## 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**.



# Music Lab Experiment

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Voting, Success,  
and Superstars  
24 of 28

## 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])



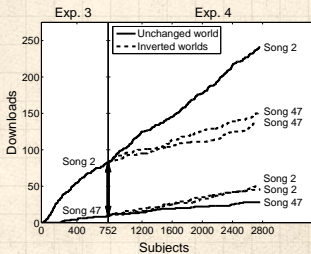
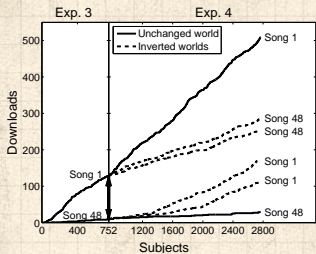
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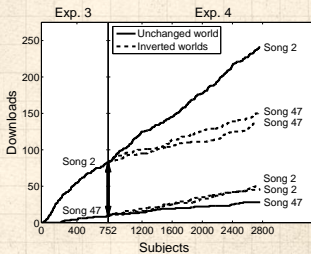
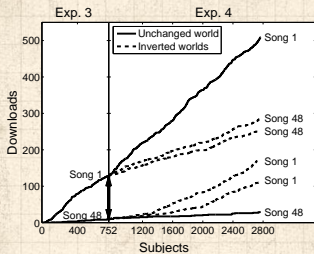
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25 of 28


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 The pretend rich get richer ...





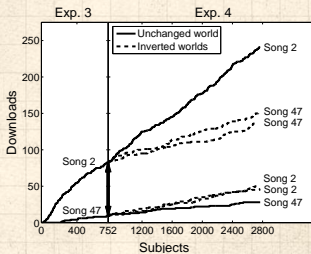
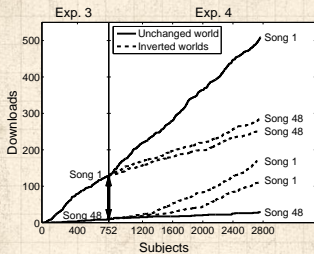
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Voting, Success,  
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25 of 28

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






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