

# Voting, Success, and Superstars

Principles of Complex Systems

CSYS/MATH 300, Spring, 2013 | #SpringPoCS2013

Winning: it's not for  
everyone

Superstars  
Musiclab

References

Prof. Peter Dodds  
@peterdodds

Department of Mathematics & Statistics | Center for Complex Systems |  
Vermont Advanced Computing Center | University of Vermont



These slides brought to you by:

Voting, Success,  
and Superstars

**Sealie &  
Lambie  
Productions**



Winning: it's not for  
everyone

Superstars

Musiclub

References



# Outline

Voting, Success,  
and Superstars

Winning: it's not for everyone

Superstars

Musiclub

Winning: it's not for  
everyone

Superstars

Musiclub

References

References



## Voting, Success, and Superstars

Winning: it's not for  
everyone

Superstars

Musiclab

References



# Where do superstars come from?

Voting, Success,  
and Superstars

Winning: it's not for  
everyone

Superstars  
Musicalab

References

Rosen (1981): “**The Economics of Superstars**” [5]

## Examples:

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





## Rosen's theory:

- ▶ Individual quality  $q$  maps to reward  $R(q)$
- ▶  $R(q)$  is 'convex' ( $d^2R/dq^2 > 0$ )
- ▶ 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'



Winning: it's not for  
everyone

Superstars

Musiclab

References

## Adler (1985): "Stardom and Talent"<sup>[1]</sup>

- ▶ 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'?)



Winning: it's not for  
everyone

Superstars

Musiclab

References

## 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.





Winning: it's not for  
everyone

Superstars

Musiclab

References

## Score-based voting versus rank-based voting:

- ▶ Balinski and Laraki<sup>[2]</sup>  
“A theory of measuring, electing, and ranking”  
Proc. Natl. Acad. Sci., pp. 8720–8725 (2007)



## Laureti et al. (2004): “Aggregating partial, local evaluations to achieve global ranking” [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

Winning: it's not for everyone

Superstars  
Musicalab

References



# Dominance hierarchies

Chase et al. (2002): “Individual differences versus social dynamics in the formation of animal dominance hierarchies” [3]

- ▶ The aggressive female *Metriaclicma zebra*:



- ▶ Pecking orders for fish...

Voting, Success,  
and Superstars

Winning: it's not for  
everyone

Superstars

Musiclab

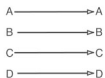
References



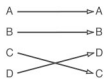
# Dominance hierarchies

## Fish forget—changing of dominance hierarchies:

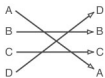
1st Hierarchy → 2nd Hierarchy



(6)

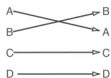


(4)

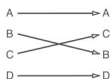


(1)

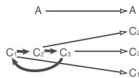
1st Hierarchy → 2nd Hierarchy



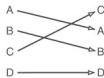
(1)



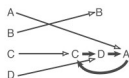
(1)



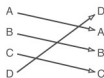
(1)



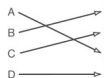
(1)



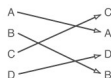
(1)



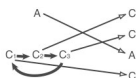
(1)



(2)



(2)



(1)

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

Winning: it's not for everyone

Superstars  
Musiclab

References



# Dominance hierarchies

Voting, Success,  
and Superstars

Winning: it's not for  
everyone

Superstars  
MusciLab

References

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>B \rightarrow A</math></p> <p>C <math>C \rightarrow D</math></p> <p>D <math>D \rightarrow C</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 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 <math>A \rightarrow B</math></p> <p>B <math>B \rightarrow A</math></p> <p>C <math>C \rightarrow D</math></p> <p>D <math>D \rightarrow C</math></p> <p>E</p> <p>(6) (1)</p>	<p>A</p> <p><math>B_1 \rightarrow B_2 \rightarrow B_3</math></p> <p>D</p> <p>E</p> <p>(2)</p> <p>n=12</p> <p><math>C_1 \rightarrow C_2 \rightarrow C_3</math></p> <p>E</p> <p>(1)</p>	<p>A</p> <p>B</p> <p><math>D_1 \rightarrow D_2 \rightarrow D_3</math></p> <p>(1)</p>

- ▶ Group versus isolated interactions produce different hierarchies





# Music Lab Experiment

Voting, Success,  
and Superstars



**BAND NAME**

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

**SONG TITLE**

**NUMBER OF DOWNLOADS**

Winning: it's not for everyone

Superstars

Musiclab

References

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?



# Music Lab Experiment

Voting, Success,  
and Superstars

Music Lab - Song Selection - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://www.musiclab.columbia.edu/me/songs

	# of down loads	[Help] [Log off]	# of down loads	# of down loads	
HARTSFIELD: "enough is enough"	20	GO MOREDCAL: "It 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	MISS OCTOBER: "pink aggression"	27	SILVERFOX: "gnaw"	17
THE BROKEN PROMISE: "the end in friend"	19	POST BREAK TRAGEDY: "flower"	14	STRANGER: "one drop"	30
THIS NEW DAWN: "the belief above the answer"	12	FORTHFADING: "tear"	24	FAR FROM KNOWN: "route 9"	18
WOONER AT NINE: "walk away"	6	THE CALEFACTION: "trapped in an orange peef"	20	STUNT MONKEY: "inside out"	46
MORAL HAZARD: "waste of my life"	8	52METRO: "lockdown"	17	DANTE: "life's mystery"	14
NOT FOR SCHOLARS: "as seasons change"	27	SIMPLY WAITING: "went with the count"	16	FADING THROUGH: "wish me luck"	30
SECRETARY: "keep your eyes on the ballistics"	5	STAR CLIMBER: "tell me"	38	UNKNOWN CITIZENS: "falling over"	34
ART OF KANLY: "reductive into, melodic breakdown"	10	THE FASTLANE: "if death do us part i dont"	31	BY NOVEMBER: "if i could take you"	20
HYDRAULIC SANDWICH: "separation anxiety"	20	A BLINDING SILENCE: "misery and ruckus"	17	DRAWN IN THE SKY: "tap the ride"	12
EMBER SKY: "this upcoming winter"	25	SUMRANA: "the bolshhevik boogie"	15	SELSIUS: "stan of the city"	22
SALUTE THE DAWN: "i am em"	13	CAPE RENAISSANCE: "baseball warlock vs"	12	SIBRIAN: "eye patch"	14
RYAN ESSMAKER: "detour, the still"	14	UP FALLS DOWN: "a brighter burning star"	11	EVAN GOLD: "inbet downey jr"	30
BEERBONG: "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

Winning: it's not for  
everyone

Superstars

Musiclab

References



Salganik et al. (2006) "An experimental study of inequality and unpredictability in an artificial cultural market" [6]

# Music Lab Experiment

Voting, Success,  
and Superstars

Winning: it's not for  
everyone

Superstars

Musiclab

References

## Experiment 1

## Experiments 2-4

	Rank	Artist	Score	Rank
WINTERFELDS Through a Storm?	28	CELEBRATION	12	29
DEEP ENDICOR TO DIE The New Day	17	FRANKIE SAVINO The New Day	10	17
THE SHUFFY SUNDAYS SUNDAY NIGHT	22	WELL DECIDED The New Day?	20	22
THE SHUFFY SUNDAYS The end of the world?	18	WELL DECIDED The New Day?	18	18
THE SHUFFY SUNDAYS The end of the world?	19	WELL DECIDED The New Day?	19	19
ROCKERS AT HOME The New Day?	10	THE COLLECTIVE The end of the world?	24	10
MORAL BEHAVIOR The end of the world?	6	LIMITED The New Day?	17	24
HOT FOR SCHOLARS The end of the world?	27	SMALL SOUNDS The end of the world?	18	27
ROCKERS AT HOME The end of the world?	11	THE COLLECTIVE The end of the world?	18	11
ROCKERS AT HOME The end of the world?	12	THE COLLECTIVE The end of the world?	12	12
ROCKERS AT HOME The end of the world?	13	THE COLLECTIVE The end of the world?	13	13
ROCKERS AT HOME The end of the world?	14	THE COLLECTIVE The end of the world?	14	14
ROCKERS AT HOME The end of the world?	15	THE COLLECTIVE The end of the world?	15	15
ROCKERS AT HOME The end of the world?	16	THE COLLECTIVE The end of the world?	16	16
ROCKERS AT HOME The end of the world?	17	THE COLLECTIVE The end of the world?	17	17
ROCKERS AT HOME The end of the world?	18	THE COLLECTIVE The end of the world?	18	18
ROCKERS AT HOME The end of the world?	19	THE COLLECTIVE The end of the world?	19	19
ROCKERS AT HOME The end of the world?	20	THE COLLECTIVE The end of the world?	20	20
ROCKERS AT HOME The end of the world?	21	THE COLLECTIVE The end of the world?	21	21
ROCKERS AT HOME The end of the world?	22	THE COLLECTIVE The end of the world?	22	22
ROCKERS AT HOME The end of the world?	23	THE COLLECTIVE The end of the world?	23	23
ROCKERS AT HOME The end of the world?	24	THE COLLECTIVE The end of the world?	24	24
ROCKERS AT HOME The end of the world?	25	THE COLLECTIVE The end of the world?	25	25
ROCKERS AT HOME The end of the world?	26	THE COLLECTIVE The end of the world?	26	26
ROCKERS AT HOME The end of the world?	27	THE COLLECTIVE The end of the world?	27	27
ROCKERS AT HOME The end of the world?	28	THE COLLECTIVE The end of the world?	28	28
ROCKERS AT HOME The end of the world?	29	THE COLLECTIVE The end of the world?	29	29
ROCKERS AT HOME The end of the world?	30	THE COLLECTIVE The end of the world?	30	30

	Rank	Artist	Score	Rank
ROCKERS AT HOME The end of the world?	28	CELEBRATION	12	29
THE SHUFFY SUNDAYS SUNDAY NIGHT	22	WELL DECIDED The New Day?	20	22
THE SHUFFY SUNDAYS The end of the world?	18	WELL DECIDED The New Day?	18	18
THE SHUFFY SUNDAYS The end of the world?	19	WELL DECIDED The New Day?	19	19
ROCKERS AT HOME The end of the world?	10	THE COLLECTIVE The end of the world?	24	10
MORAL BEHAVIOR The end of the world?	6	LIMITED The New Day?	17	24
HOT FOR SCHOLARS The end of the world?	27	SMALL SOUNDS The end of the world?	18	27
ROCKERS AT HOME The end of the world?	11	THE COLLECTIVE The end of the world?	18	11
ROCKERS AT HOME The end of the world?	12	THE COLLECTIVE The end of the world?	12	12
ROCKERS AT HOME The end of the world?	13	THE COLLECTIVE The end of the world?	13	13
ROCKERS AT HOME The end of the world?	14	THE COLLECTIVE The end of the world?	14	14
ROCKERS AT HOME The end of the world?	15	THE COLLECTIVE The end of the world?	15	15
ROCKERS AT HOME The end of the world?	16	THE COLLECTIVE The end of the world?	16	16
ROCKERS AT HOME The end of the world?	17	THE COLLECTIVE The end of the world?	17	17
ROCKERS AT HOME The end of the world?	18	THE COLLECTIVE The end of the world?	18	18
ROCKERS AT HOME The end of the world?	19	THE COLLECTIVE The end of the world?	19	19
ROCKERS AT HOME The end of the world?	20	THE COLLECTIVE The end of the world?	20	20
ROCKERS AT HOME The end of the world?	21	THE COLLECTIVE The end of the world?	21	21
ROCKERS AT HOME The end of the world?	22	THE COLLECTIVE The end of the world?	22	22
ROCKERS AT HOME The end of the world?	23	THE COLLECTIVE The end of the world?	23	23
ROCKERS AT HOME The end of the world?	24	THE COLLECTIVE The end of the world?	24	24
ROCKERS AT HOME The end of the world?	25	THE COLLECTIVE The end of the world?	25	25
ROCKERS AT HOME The end of the world?	26	THE COLLECTIVE The end of the world?	26	26
ROCKERS AT HOME The end of the world?	27	THE COLLECTIVE The end of the world?	27	27
ROCKERS AT HOME The end of the world?	28	THE COLLECTIVE The end of the world?	28	28
ROCKERS AT HOME The end of the world?	29	THE COLLECTIVE The end of the world?	29	29
ROCKERS AT HOME The end of the world?	30	THE COLLECTIVE The end of the world?	30	30



# Music Lab Experiment

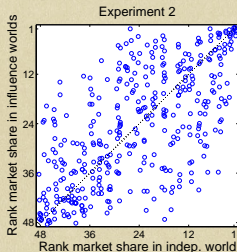
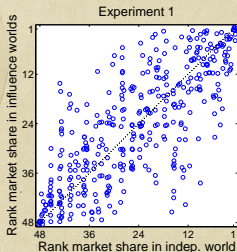
Voting, Success,  
and Superstars

Winning: it's not for  
everyone

Superstars

Musiclab

References



- ▶ Variability in final rank.



# Music Lab Experiment

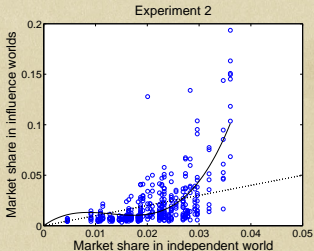
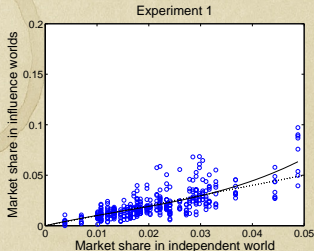
Voting, Success,  
and Superstars

Winning: it's not for  
everyone

Superstars

Musiclab

References



- ▶ Variability in final number of downloads.





# Music Lab Experiment

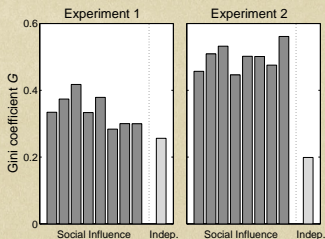
Voting, Success,  
and Superstars

Winning: it's not for  
everyone

[Superstars](#)

[Musiclab](#)

[References](#)



- 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

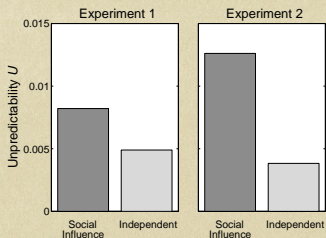
Voting, Success,  
and Superstars

Winning: it's not for  
everyone

Superstars

Musiclab

References



## ► 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

Voting, Success,  
and Superstars

## 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... [7, 8])

Winning: it's not for  
everyone

Superstars

Musiclab

References



# Music Lab Experiment—Sneakiness

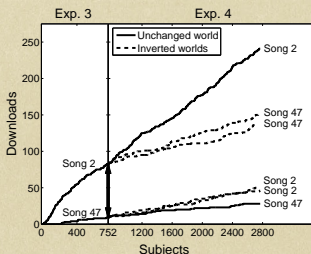
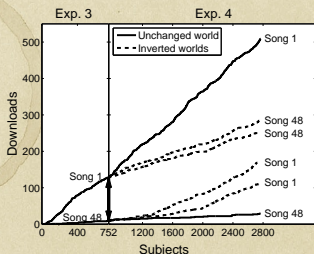
Voting, Success,  
and Superstars

Winning: it's not for  
everyone

Superstars

Musiclab

References



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



# References I

[1] M. Adler.  
Stardom and talent.  
[American Economic Review](#), pages 208–212, 1985.  
[pdf](#) (田)

[2] M. Balinski and R. Laraki.  
A theory of measuring, electing, and ranking.  
[Proc. Natl. Acad. Sci.](#), 104(21):8720–8725, 2007.  
[pdf](#) (田)

[3] I. D. Chase, C. Tovey, D. Spangler-Martin, and  
M. Manfredonia.  
Individual differences versus social dynamics in the  
formation of animal dominance hierarchies.  
[Proc. Natl. Acad. Sci.](#), 99(8):5744–5749, 2002.  
[pdf](#) (田)

Winning: it's not for  
everyone  
Superstars  
Musicalab

References





# References II

- [4] P. Laureti, L. Moret, and Y.-C. Zhang.  
Aggregating partial, local evaluations to achieve  
global ranking.  
[Physica A](#), 345(3–4):705–712, 2004. [pdf](#) (田)
- [5] S. Rosen.  
The economics of superstars.  
[Am. Econ. Rev.](#), 71:845–858, 1981. [pdf](#) (田)
- [6] M. J. Salganik, P. S. Dodds, and D. J. Watts.  
An experimental study of inequality and  
unpredictability in an artificial cultural market.  
[Science](#), 311:854–856, 2006. [pdf](#) (田)
- [7] C. R. Sunstein.  
Infotopia: How many minds produce knowledge.  
Oxford University Press, New York, 2006.



# References III

Voting, Success,  
and Superstars

Winning: it's not for  
everyone

Superstars

Musiclab

References

- [8] N. N. Taleb.  
The Black Swan.  
Random House, New York, 2007.

