

Voting, Success, and Superstars

Principles of Complex Systems
CSYS/MATH 300, Fall, 2010

Prof. Peter Dodds

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



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COMPLEX SYSTEMS CENTER



Voting, Success,
and Superstars

Winning: it's not for
everyone

Superstars
Musiclub

Final words

References



Outline

Winning: it's not for everyone

Superstars

Musiclab

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Where do superstars come from?

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

Examples:

- ▶ Full-time Comedians (≈ 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' ($d^2R/dq^2 > 0$)
- ▶ 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'

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Adler (1985): “Stardom and Talent”^[1]

- ▶ 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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Score-based voting versus rank-based voting:

- ▶ Balinski and Laraki^[2]
“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

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Dominance hierarchies

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

The aggressive female *Metriacrima zebra*:



Pecking orders for fish...

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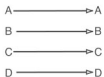
References



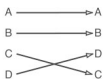
Dominance hierarchies

► Fish forget—changing of dominance hierarchies:

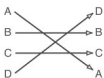
1st Hierarchy \Rightarrow 2nd Hierarchy



(6)

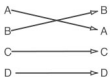


(4)

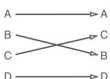


(1)

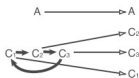
1st Hierarchy \Rightarrow 2nd Hierarchy



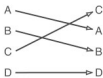
(1)



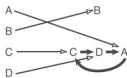
(1)



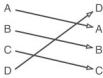
(1)



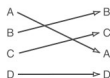
(1)



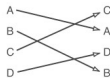
(1)



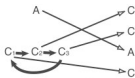
(1)



(2)



(2)



(1)

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

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

- ▶ Group versus isolated interactions produce different hierarchies



Music Lab Experiment



48 songs

30,000 participants

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

BAND NAME

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

SONG TITLE

NUMBER OF DOWNLOADS

multiple 'worlds'

Inter-world variability

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	# of down loads	[Help] [Log off]	# of down loads	# of down loads	
HARTSFIELD: "enough is enough"	20	GO MOREDECA: "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: "fear"	24	FAR FROM KNOWN: "route 9"	18
WOONER AT NINE: "walk away"	6	THE CALEFACTION: "trapped in an orange peef"	20	STUNT MONKEY: "inside our"	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 ballistic"	5	STAR CLIMBER: "tell me"	38	UNKNOWN CITIZENS: "falling over"	34
ART OF KANLY: "seductive into, medic breakdown"	10	THE FASTLANE: "if death do us part i dant"	11	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 bolshievsk boogie"	15	SELSIUS: "stan of the city"	22
SALUTE THE DAWN: "i am em"	13	CAPE RENAISSANCE: "baseball warlock v1"	12	SIBIRIAN: "eye patch"	14
RYAN ESSMAKER: "detour, the still"	14	UP FALLS DOWN: "a brighter burning star"	11	EVAN GOLD: "albert downey jr"	30
BEERBONG: "father to son"	12	SUMMERSWASTED: "a plan behind destruction"	17	BENEFIT OF A DOUBT: "fun army"	38
HALL OF FAME: "best mistakes"	19	SILENT FILM: "all i have to say"	61	SHIPWRECK UNION: "out of the woods"	16

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

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Experiment 1

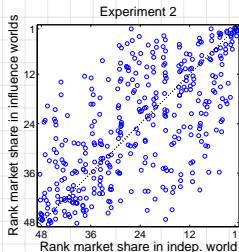
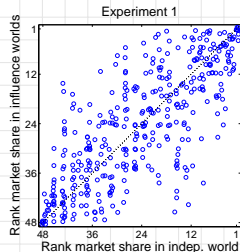
Experiments 2-4

Rank	Artist	Score	Rank	Artist	Score
1	WINTERGUILD "Through a Veil"	28	12	TRIP "Dude, You Rock (feat. ...)"	24
2	DEEP ECHOES TO GO "The Way We"	27	13	UP FOR NOTHING "Up for Nothing"	23
3	THE SHARP TONGUES "Singing in the Rain"	26	14	BELETRON "Dude"	22
4	THE SHARPS & POINTS "The End of the World"	25	15	CRAMPTON "You Are"	21
5	THE SHARPS & POINTS "The End of the World"	24	16	THE SHARPS & POINTS "The End of the World"	20
6	THE SHARPS & POINTS "The End of the World"	23	17	THE SHARPS & POINTS "The End of the World"	19
7	THE SHARPS & POINTS "The End of the World"	22	18	THE SHARPS & POINTS "The End of the World"	18
8	THE SHARPS & POINTS "The End of the World"	21	19	THE SHARPS & POINTS "The End of the World"	17
9	THE SHARPS & POINTS "The End of the World"	20	20	THE SHARPS & POINTS "The End of the World"	16
10	THE SHARPS & POINTS "The End of the World"	19	21	THE SHARPS & POINTS "The End of the World"	15
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14	THE SHARPS & POINTS "The End of the World"	15	25	THE SHARPS & POINTS "The End of the World"	11
15	THE SHARPS & POINTS "The End of the World"	14	26	THE SHARPS & POINTS "The End of the World"	10
16	THE SHARPS & POINTS "The End of the World"	13	27	THE SHARPS & POINTS "The End of the World"	9
17	THE SHARPS & POINTS "The End of the World"	12	28	THE SHARPS & POINTS "The End of the World"	8
18	THE SHARPS & POINTS "The End of the World"	11	29	THE SHARPS & POINTS "The End of the World"	7
19	THE SHARPS & POINTS "The End of the World"	10	30	THE SHARPS & POINTS "The End of the World"	6
20	THE SHARPS & POINTS "The End of the World"	9	31	THE SHARPS & POINTS "The End of the World"	5
21	THE SHARPS & POINTS "The End of the World"	8	32	THE SHARPS & POINTS "The End of the World"	4
22	THE SHARPS & POINTS "The End of the World"	7	33	THE SHARPS & POINTS "The End of the World"	3
23	THE SHARPS & POINTS "The End of the World"	6	34	THE SHARPS & POINTS "The End of the World"	2
24	THE SHARPS & POINTS "The End of the World"	5	35	THE SHARPS & POINTS "The End of the World"	1

Rank	Artist	Score	Rank	Artist	Score
1	WINTERGUILD "Through a Veil"	28	12	TRIP "Dude, You Rock (feat. ...)"	24
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18	THE SHARPS & POINTS "The End of the World"	11	29	THE SHARPS & POINTS "The End of the World"	7
19	THE SHARPS & POINTS "The End of the World"	10	30	THE SHARPS & POINTS "The End of the World"	6
20	THE SHARPS & POINTS "The End of the World"	9	31	THE SHARPS & POINTS "The End of the World"	5
21	THE SHARPS & POINTS "The End of the World"	8	32	THE SHARPS & POINTS "The End of the World"	4
22	THE SHARPS & POINTS "The End of the World"	7	33	THE SHARPS & POINTS "The End of the World"	3
23	THE SHARPS & POINTS "The End of the World"	6	34	THE SHARPS & POINTS "The End of the World"	2
24	THE SHARPS & POINTS "The End of the World"	5	35	THE SHARPS & POINTS "The End of the World"	1



Music Lab Experiment



- ▶ Variability in final rank.

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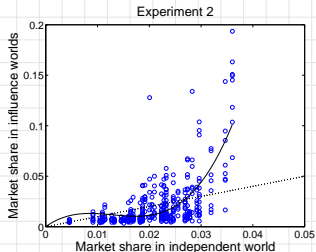
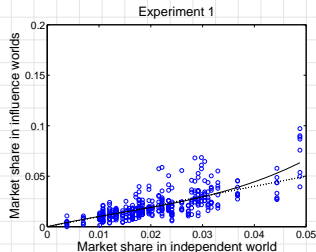
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- ▶ Variability in final number of downloads.



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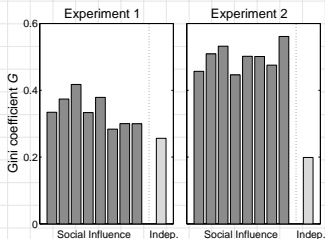
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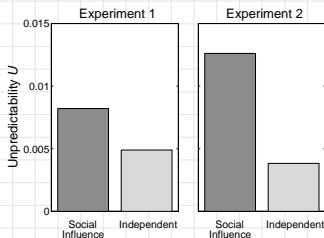


- ▶ Inequality as measured by Gini coefficient:

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



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► 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**.

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])



Music Lab Experiment—Sneakiness

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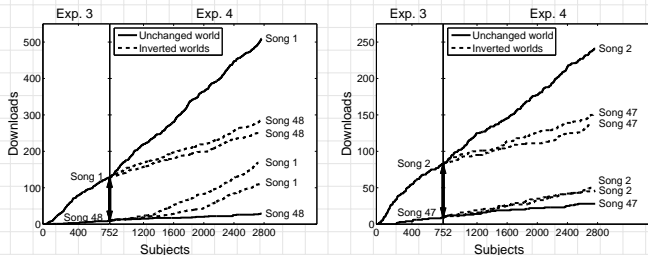
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- ▶ Inversion of download count
- ▶ The pretend rich get richer ...
- ▶ ... but at a slower rate



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Modern science in three steps:

1. Find interesting/meaningful/important phenomena involving spectacular amounts of data.
2. Describe what you see.
3. Explain it.



Next Semester

For your consideration:

Spring 2011: Complex Networks (CSYS/MATH 303)

- ▶ Branching networks (rivers, cardiovascular systems)
- ▶ Redistribution networks (airlines, post)
- ▶ Structure detection for complex systems
- ▶ Contagion
- ▶ Random networks-arama
- ▶ Distributed Search
- ▶ Organizational networks
- ▶ Deeper investigations of scale-free networks
- ▶ and more...

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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)



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

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

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