

Voting, Success, and Superstars

Principles of Complex Systems
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The
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COMPLEX SYSTEMS CENTER



Voting, Success,
and Superstars

Winning: it's not for
everyone

Superstars
Musiclab

Final words

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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)

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- ▶ 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
 2. Technology
- ▶ 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’?)



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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 *Metriaclima zebra*:



Pecking orders for fish...

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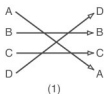
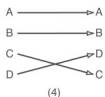
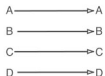
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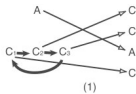
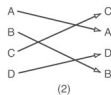
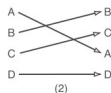
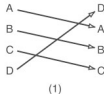
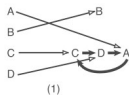
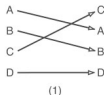
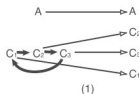
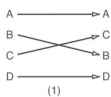
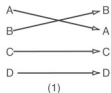
Dominance hierarchies

► Fish forget—changing of dominance hierarchies:

1st Hierarchy \Rightarrow 2nd Hierarchy



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

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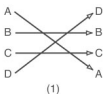
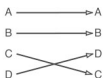
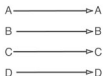
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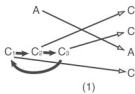
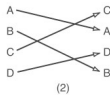
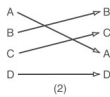
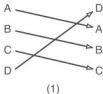
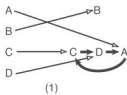
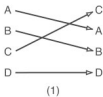
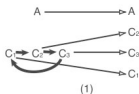
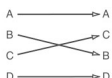
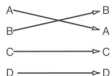
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Methods of Forming Hierarchies

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 $C \leftarrow D$</p> <p>D $C \leftarrow D$</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 $C \leftarrow D$</p> <p>D $C \leftarrow D$</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



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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
"framed"		
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 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: "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

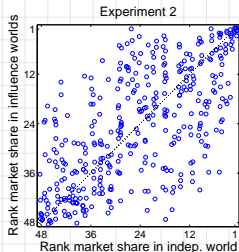
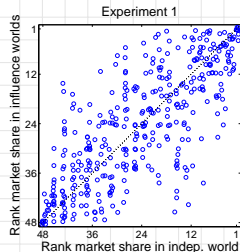
Experiments 2-4

Rank	Artist	Score	Rank	Artist	Score
1	WINTERGUILD "Through a Veil"	28	12	TRIP "Dance for me like you do"	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 "Dance"	22
4	THE SHARPS "The Sharps"	25	15	CRAMERSON "You are"	21
5	THE SHARPS "The Sharps"	24	16	THE SHARPS "The Sharps"	20
6	THE SHARPS "The Sharps"	23	17	THE SHARPS "The Sharps"	19
7	THE SHARPS "The Sharps"	22	18	THE SHARPS "The Sharps"	18
8	THE SHARPS "The Sharps"	21	19	THE SHARPS "The Sharps"	17
9	THE SHARPS "The Sharps"	20	20	THE SHARPS "The Sharps"	16
10	THE SHARPS "The Sharps"	19	21	THE SHARPS "The Sharps"	15
11	THE SHARPS "The Sharps"	18	22	THE SHARPS "The Sharps"	14
12	THE SHARPS "The Sharps"	17	23	THE SHARPS "The Sharps"	13
13	THE SHARPS "The Sharps"	16	24	THE SHARPS "The Sharps"	12
14	THE SHARPS "The Sharps"	15	25	THE SHARPS "The Sharps"	11
15	THE SHARPS "The Sharps"	14	26	THE SHARPS "The Sharps"	10
16	THE SHARPS "The Sharps"	13	27	THE SHARPS "The Sharps"	9
17	THE SHARPS "The Sharps"	12	28	THE SHARPS "The Sharps"	8
18	THE SHARPS "The Sharps"	11	29	THE SHARPS "The Sharps"	7
19	THE SHARPS "The Sharps"	10	30	THE SHARPS "The Sharps"	6
20	THE SHARPS "The Sharps"	9	31	THE SHARPS "The Sharps"	5
21	THE SHARPS "The Sharps"	8	32	THE SHARPS "The Sharps"	4
22	THE SHARPS "The Sharps"	7	33	THE SHARPS "The Sharps"	3
23	THE SHARPS "The Sharps"	6	34	THE SHARPS "The Sharps"	2
24	THE SHARPS "The Sharps"	5	35	THE SHARPS "The Sharps"	1

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- ▶ Variability in final rank.

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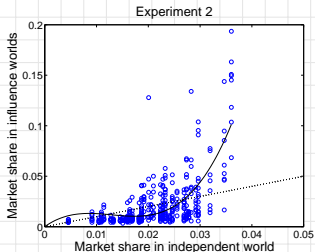
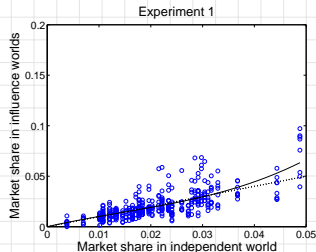
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- ▶ Variability in final number of downloads.



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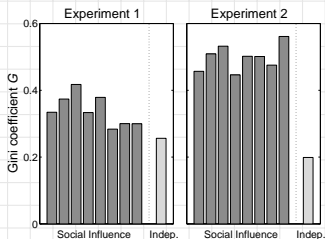
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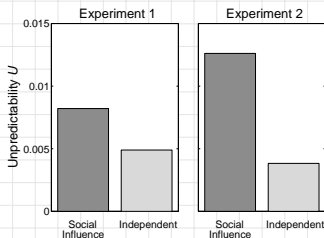


- ▶ Inequality as measured by Gini coefficient:

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



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► 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**.

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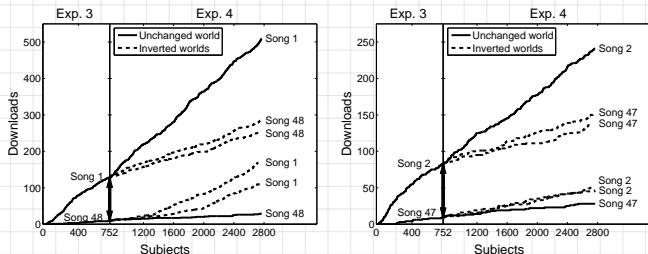
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- ▶ Inversion of download count
- ▶ The pretend rich get richer ...
- ▶ ... but at a slower rate



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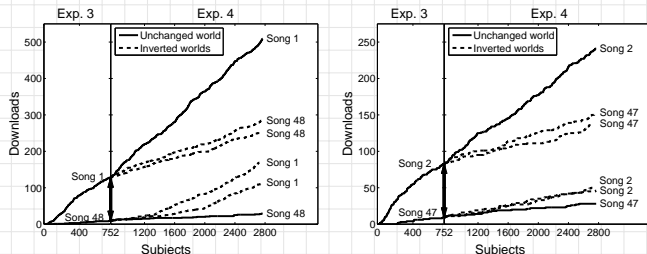
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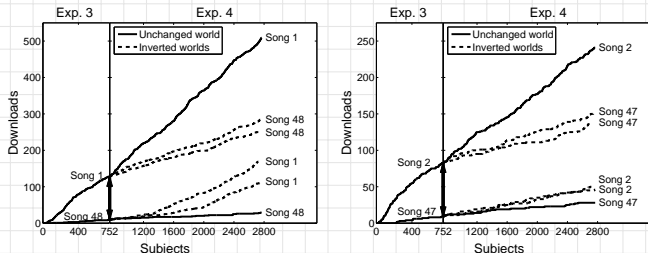
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Final words:

Modern science in three steps:

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



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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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