Voting, Success, and Superstars

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

Prof. Peter Sheridan Dodds

Computational Story Lab | Vermont Complex Systems Center
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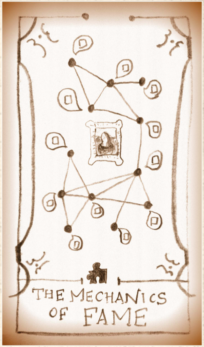
Outline

Winning: it's not for everyone

- Superstars
- Musiclab

References


THE SUN
THE GOLDEN AGE OF REDUCTIONISM
THE MANIFESTO
WELL OF SCALES
THE LAWS OF DECAYING POWER
THE UNEXPECTED TRANSFIGURATION
MINISTRY OF RANDOM WALKS
THE RICH GET RICHER
THE DREAM OF EFFICIENT LANGUAGE
THE LAW OF DIGITS FIRST
THE SURPRISE OF BEING ROBUST YET FRAGILE
THE MISREADING OF THE BOOK OF SAND
THE MANY TAILS OF MANY TAILS
THE MEASURING
THE DATA POOR
THE POURING DATA
THE CHARMS OF THE MANY WRONG PATHS
THE DOORS THAT SHOULD NOT BE OPENED
THE KNOWLEDGE OF DEAD MONKS
THE EMERGENCE OF STRUCTURE
THE EMERGENCE OF DESTRUCTION
THE EMERGENCE OF THINKING
THE EMERGENCE OF STORIES
THE MECHANICS STATISTICAL
THE THRESHOLDS OF PERCOLATION
THE NETWORKS COMPLEX
THE ELEMENTS OF WEBS
THE BIRDS OF A FEATHER
THE BIRDS OF NOT A FEATHER
THE ARK OF THE RANDOM NETWORK
THE STRANGENESS OF FRIENDS
THE SMALLNESS OF WORLDS
THE THEORY OF SIX DEGREES
THE NETWORKS FREE OF SCALE
THE CONTAGION
THE CONFUSION OF CONTAGIONS
THE DISEASE OF RANDOM MIXING
THE UNENDING PANDEMICS
THE THRESHOLDS OF THE MIND
THE SOCIAL WILD
THE SOCIAL CONTAGION
THE RATIO OF GAIN
THE TALK OF FAME
THE STORIES CONTAGIOUS
THE JOHN DORY
THE ADJACENT NARRATIVES
THE STORYTELLERS
THE FATED ASTRAL PATH
THE PATHS OF UNIVERSALITY
THE DEPENDENT PATHS
THE TROUSERS OF BIFURCATING REALITIES
THE UNKNOWN MECHANISM
THE LANDSCAPE OF FORKING PATHS
THE NETWORKS OF BLOOD
THE TREES OF REALITY
THE ORDERS OF STREAMS
THE LAWS OF BRANCHING
THE SCALING OF BROKEN HIERARCHIES
THE BRAID OR THE BRANCH
THE LAW OF OPTIMAL FORKS
THE CHURCH OF QUARTEROLOGY
THE TRUTHICIDE
THE FAMILY OF PANCAKE COWS
THE FAMILY OF SPHERICAL COWS
THE IMPROBABLE PACHYDERM
THE ILL-SCALING OF ALLOMETRIC BODIES
THE SUPPLY MOST FAIR
THE SUPPLY TO THE MOST
THE DARK ART OF GENERATING FUNCTIONS
THE RANDOM SUM OF RANDOMNESS
THE TWO-SIDED WORLDS
THE STORIES AND THE TROPES
THE TRUTH OF DIFFUSION
THE UNVEILING OF HIDDEN POWERS
THE LIMITS OF ORGANIZATIONS


THE MECHANICS OF FAME

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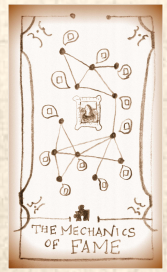

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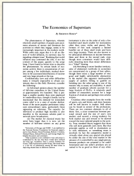
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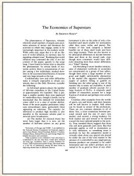
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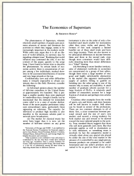
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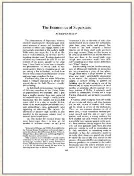
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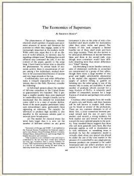
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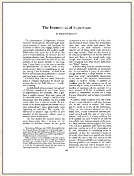
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- Highly skewed distributions again...

Superstars

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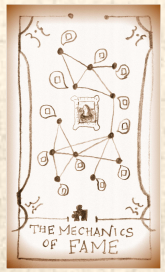

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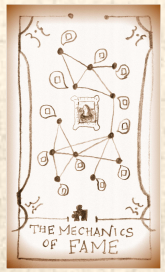

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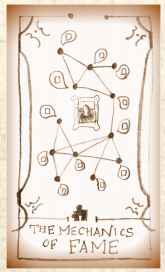

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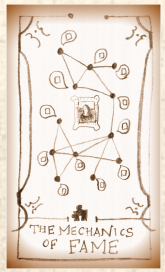

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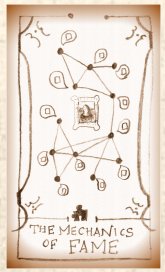

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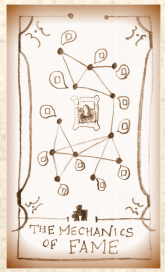

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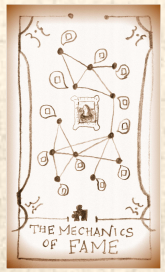

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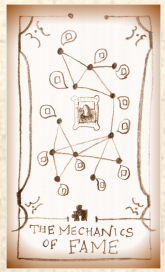

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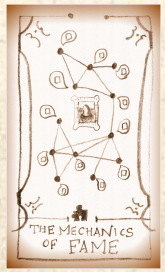
- No social element—success follows 'inherent quality'.



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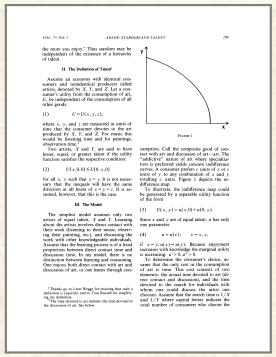

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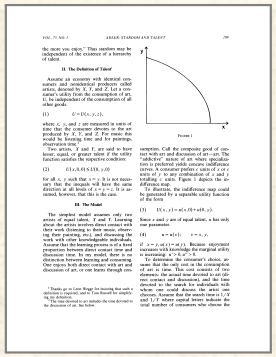

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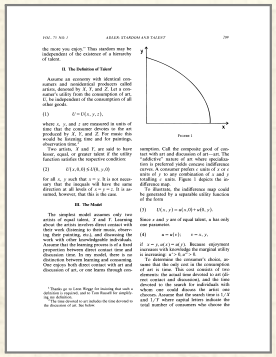

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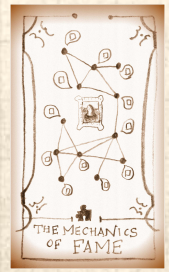

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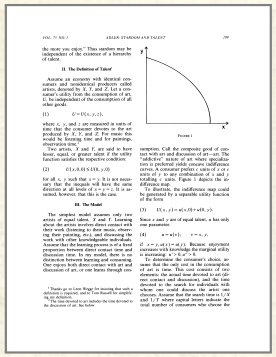

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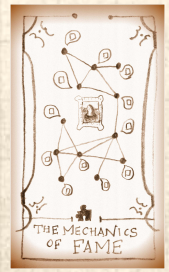

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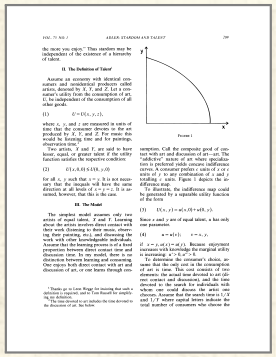

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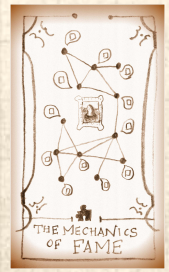
- Success can be purely a social construction
- (How can we measure 'inherent quality'?)

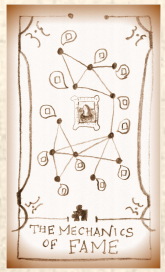


Voting

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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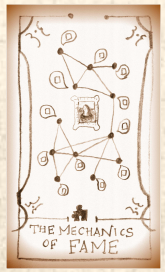
Score-based voting versus rank-based voting:


A theory of measuring, electing, and ranking

"A theory of measuring, electing, and ranking"
Balinski and Laraki,
Proc. Natl. Acad. Sci., **104**, 8720–8725, 2007. [2]



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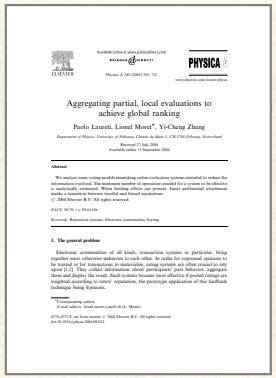

Aggregating partial, local evaluations to achieve global ranking

Paolo Laureti, Lionel Moret*, Yi-Cheng Zhang

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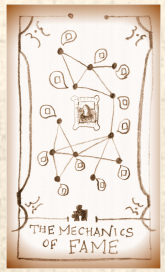

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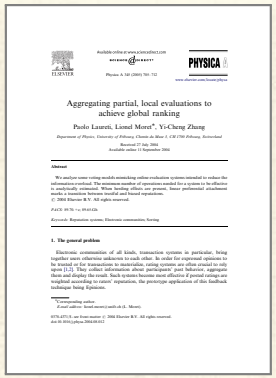
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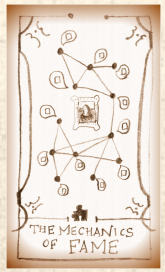

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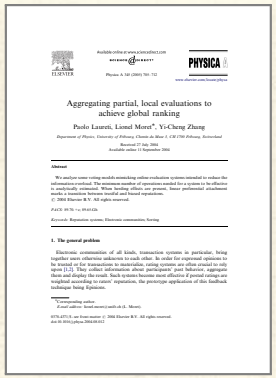

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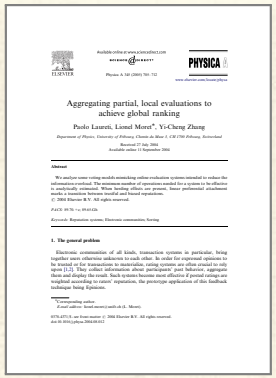

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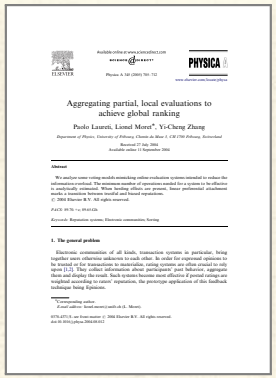

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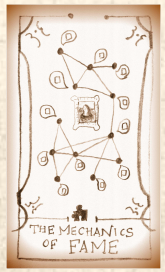
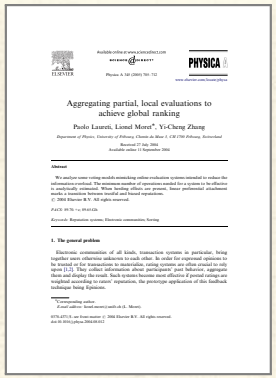
- If $\alpha > 1$, some objects are never evaluated and mistakes are made...



Voting


Aggregating partial, local evaluations to achieve global ranking

Paolo Laureti, Lionel Moret*, Yi-Cheng Zhang

"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
- 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

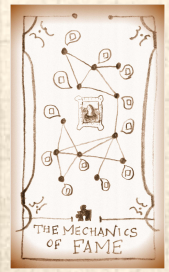
Dominance hierarchies


Individual differences versus social dynamics in the formation of animal dominance hierarchies

"Individual differences versus social dynamics in the formation of animal dominance hierarchies"
Chase et al.,
Proc. Natl. Acad. Sci., **99**, 5744-5749, 2002. [3]

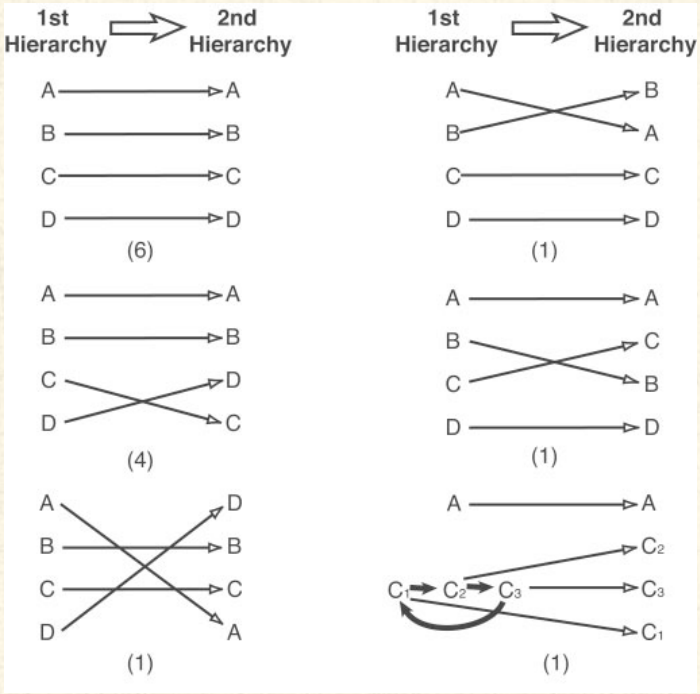
- The aggressive female Metriaclima zebra:

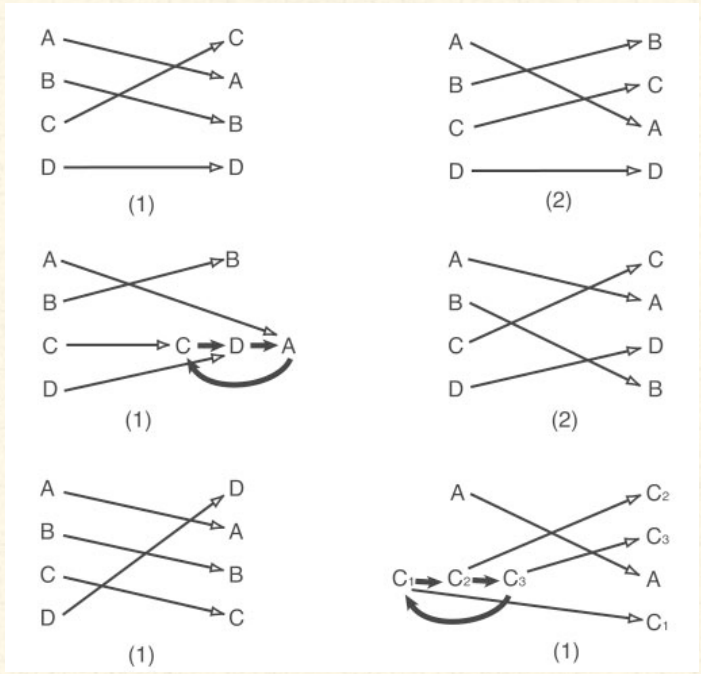
- Pecking orders for fish...



Dominance hierarchies

Fish forget—changing of dominance hierarchies:





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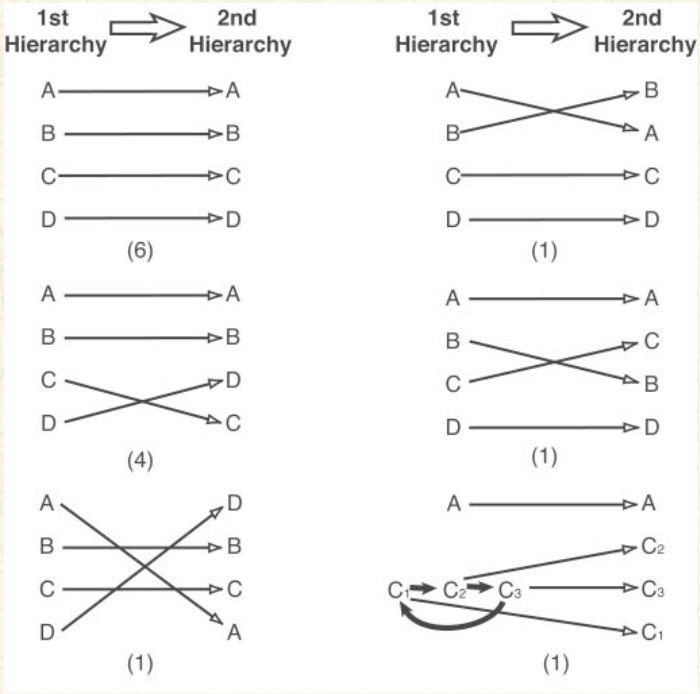
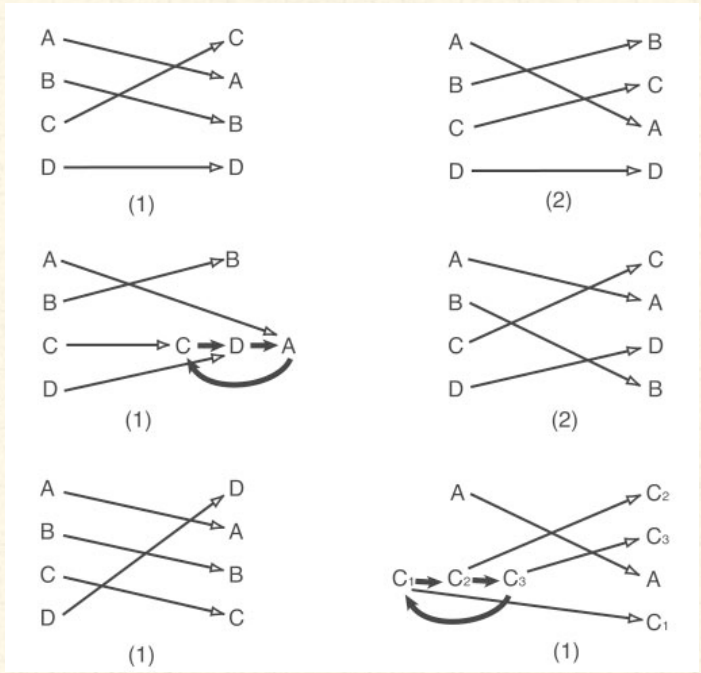




22 observations: about 3/4 of the time, hierarchy changed

Dominance hierarchies

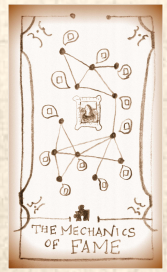
Methods of Forming Hierarchies

Size of set	Group assembly	Round-robin competition
4	A B C D (23) — A, $C_1 \to C_2 \to C_3$ (2); n=25	A B C D (9) — A, B, C, D (3) — A, $C_1 \to C_2 \to C_3$ (3) — D, $B_1 \to B_2 \to B_3$ (1); n=16
5	A B C D E (10) — A, B, C, D, E (1); n=11	A B C D E (6) — A, B, C, D, E (1) — A, B, C, D, E (1) — D, E, $B_1 \to B_2 \to B_3$ (2) — E, $C_1 \to C_2 \to C_3$ (1) — B, $D_1 \to D_2 \to D_3$ (1); n=12

- Group versus isolated interactions produce different hierarchies

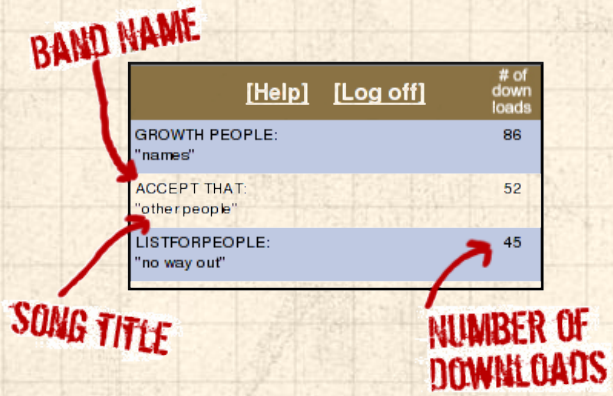
Outline

Winning: it's not for everyone



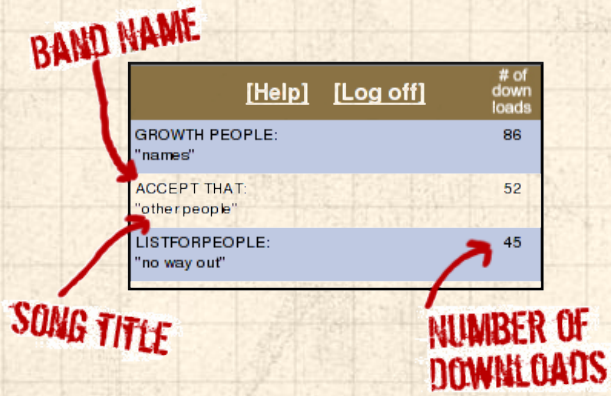
Music Lab Experiment

48 songs
30,000 participants



multiple 'worlds'
Inter-world variability

Music Lab Experiment



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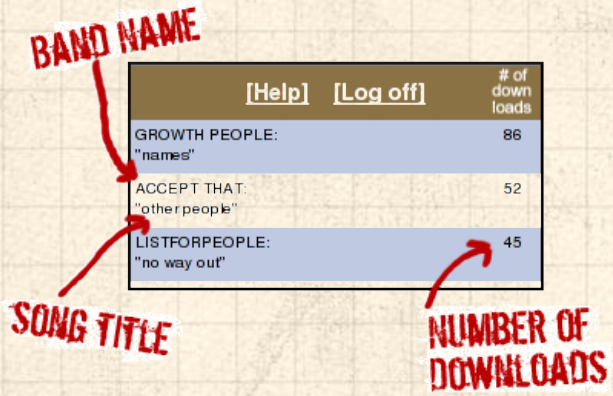
30,000 participants

multiple 'worlds'
Inter-world variability

How probable is the world?

Music Lab Experiment



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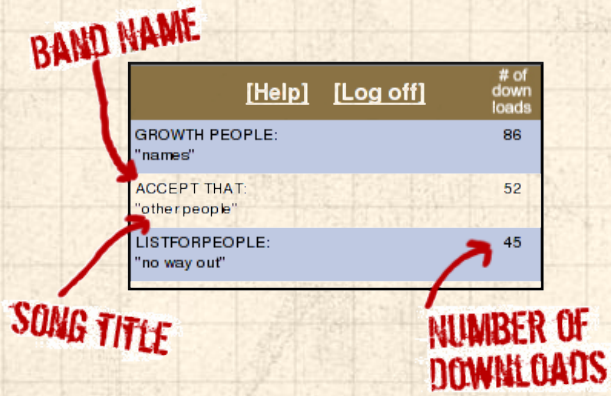
30,000 participants

multiple 'worlds'
Inter-world variability

- How probable is the world?
- Can we estimate variability?

Music Lab Experiment



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

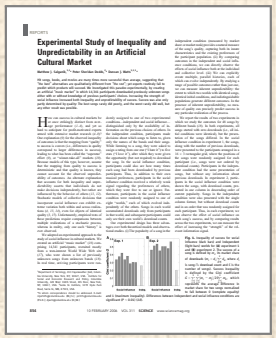
Music Lab – Song Selection - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

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

[Help] [Log off]

	# of downloads		# of downloads		# of downloads
HARTSFIELD: "enough is enough"	20	GO MOREDCAI: "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 agression"	27	SILVERFOX: "gnaw"	17
THE BROKEN PROMISE: "the end in friend"	19	POST BREAK TRAGEDY: "florence"	14	STRANGER: "one drop"	10
THIS NEW DAWN: "the belief above the answer"	12	FORTHFADING: "fear"	24	FAR FROM KNOWN: "route 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	52METRO: "lockdown"	17	DANTE: "lifes mystery"	14
NOT FOR SCHOLARS: "as seasons change"	27	SIMPLY WAITING: "went with the count"	16	FADING THROUGH: "wish me luck"	10
SECRETARY: "keep your eyes on the ballistics"	5	STAR CLIMBER: "tell me"	38	UNKNOWN CITIZENS: "falling over"	34
ART OF KANLY: "seductive intro, melodic breakdown"	10	THE FASTLANE: "til death do us part (i dont)"	31	BY NOVEMBER: "if i could take you"	20
HYDRAULIC SANDWICH: "separation anxiety"	20	A BLINDING SILENCE: "miseries and miracles"	17	DRAWN IN THE SKY: "tap the ride"	12
EMBER SKY: "this upcoming winter"	25	SUM RANA: "the bolshevik boogie"	15	SELSIUS: "stars of the city"	22
SALUTE THE DAWN: "i am error"	13	CAPE RENEWAL: "baseball warlock v1"	12	SIBRIAN: "eye patch"	14
RYAN ESSMAKER: "detour_(be still)"	14	UP FALLS DOWN: "a brighter burning star"	11	EVAN GOLD: "robert downey jr"	10
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



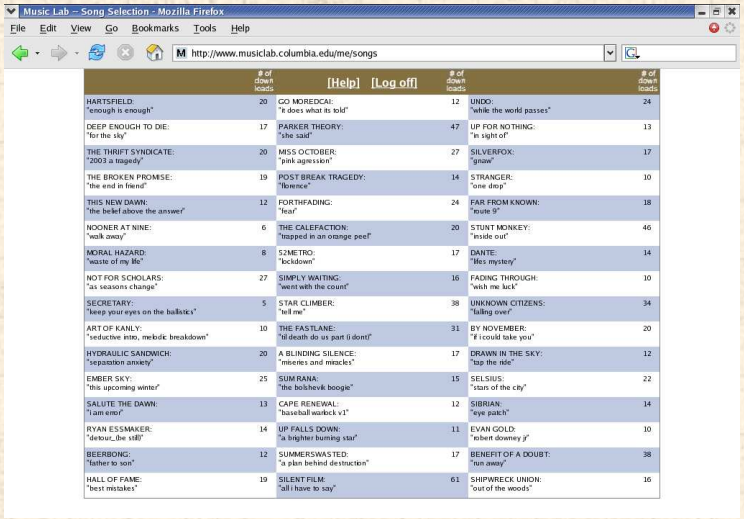
Experimental Study of Inequality and Unpredictability in an Artificial Cultural Market

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

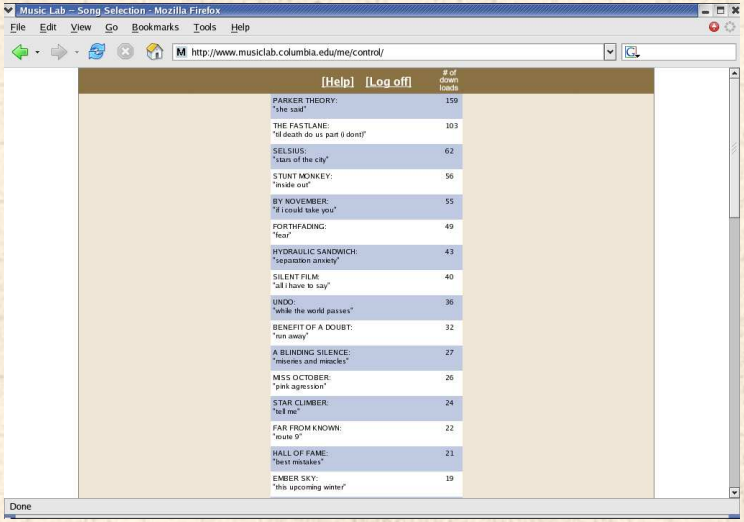
Salganik, Dodds, and Watts,
Science, **311**, 854–856, 2006. [6]

Music Lab Experiment

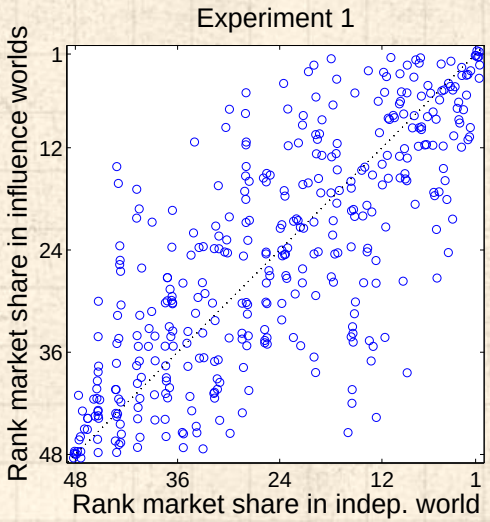
Experiment 1

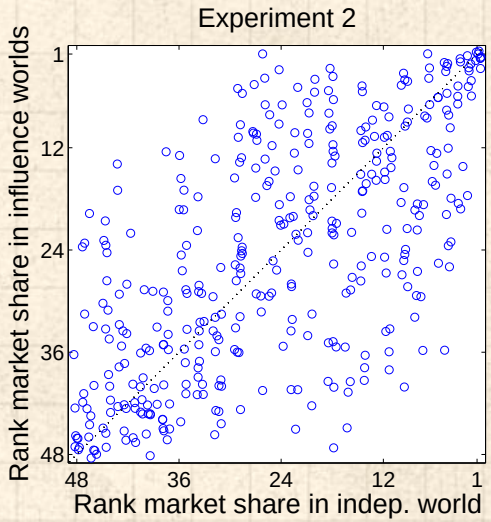


Experiments 2–4



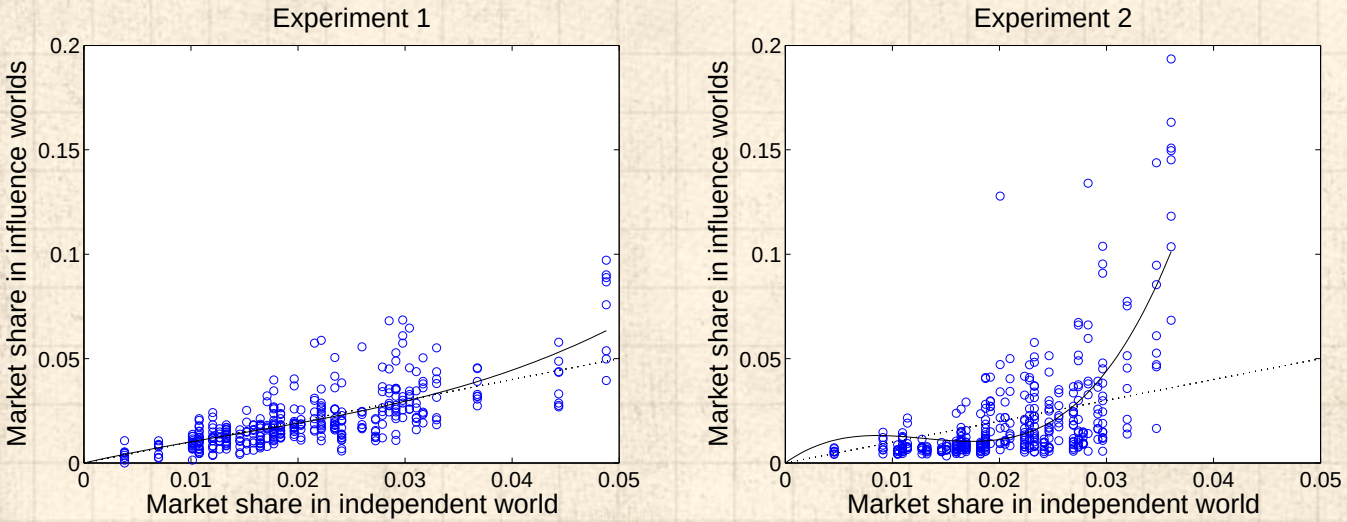
Music Lab Experiment





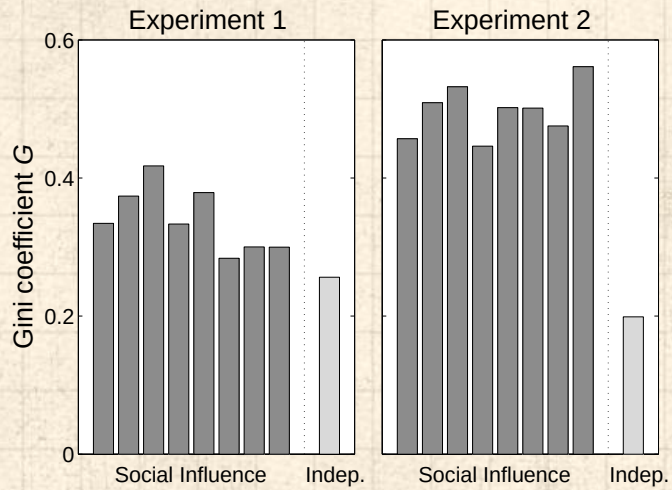
- Variability in final rank.

Music Lab Experiment



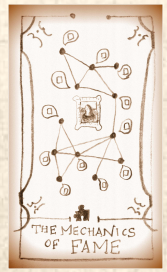
- Variability in final number of downloads.

Music Lab Experiment

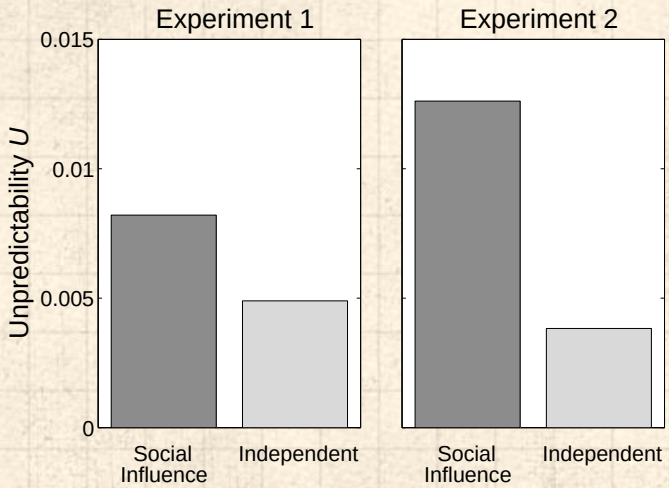


Inequality as measured by Gini coefficient:

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

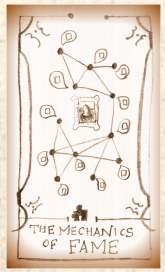


Music Lab Experiment



Unpredictability

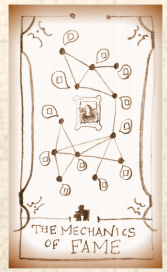
$$U = \frac{1}{N_s \binom{N_w}{2}} \sum_{i=1}^{N_s} \sum_{j=1}^{N_w} \sum_{k=j+1}^{N_w} |m_{i,j} - m_{i,k}|$$



Music Lab Experiment

Sensible result:

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



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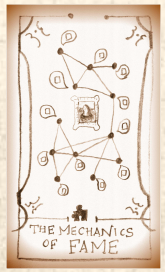

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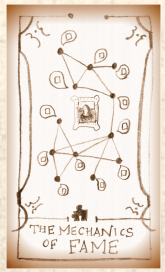

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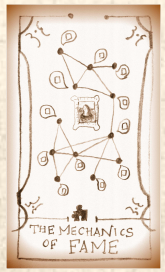
Very peculiar observation:



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Sensible result:

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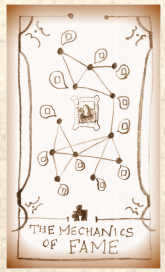
- Stronger social signal leads to greater unpredictability.

Very peculiar observation:

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



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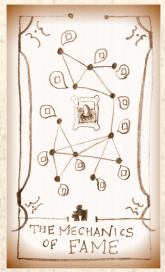
- The most unequal distributions would suggest the greatest variation in underlying 'quality.'
- But success may be due to social construction through following.



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Very peculiar observation:

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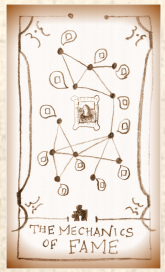
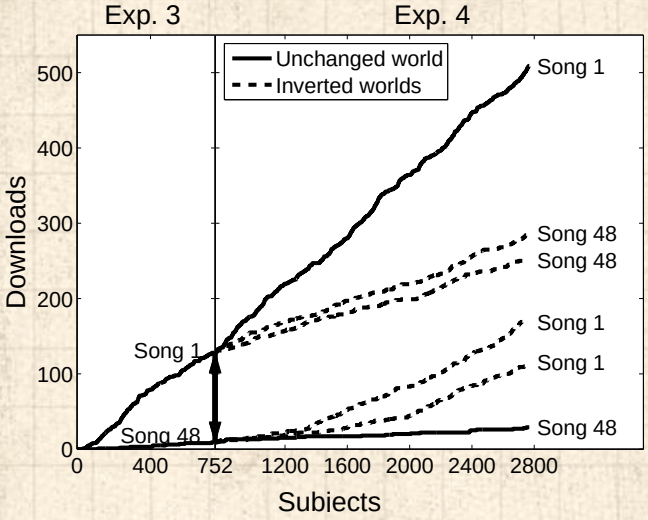
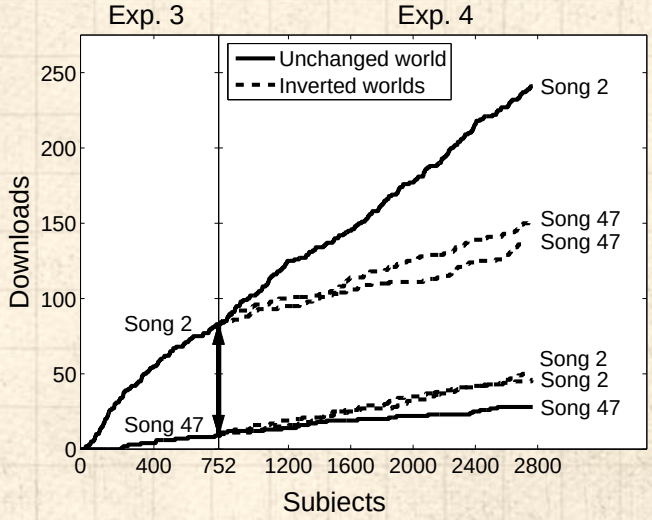
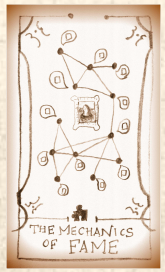


Music Lab Experiment—Sneakiness [7]





- Inversion of download count



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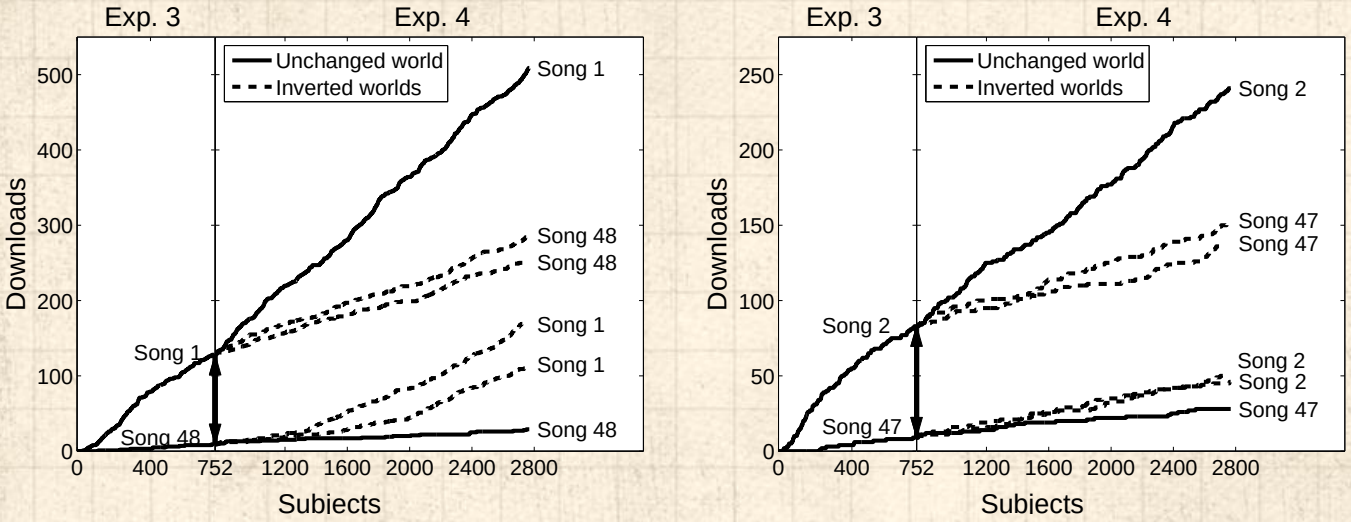
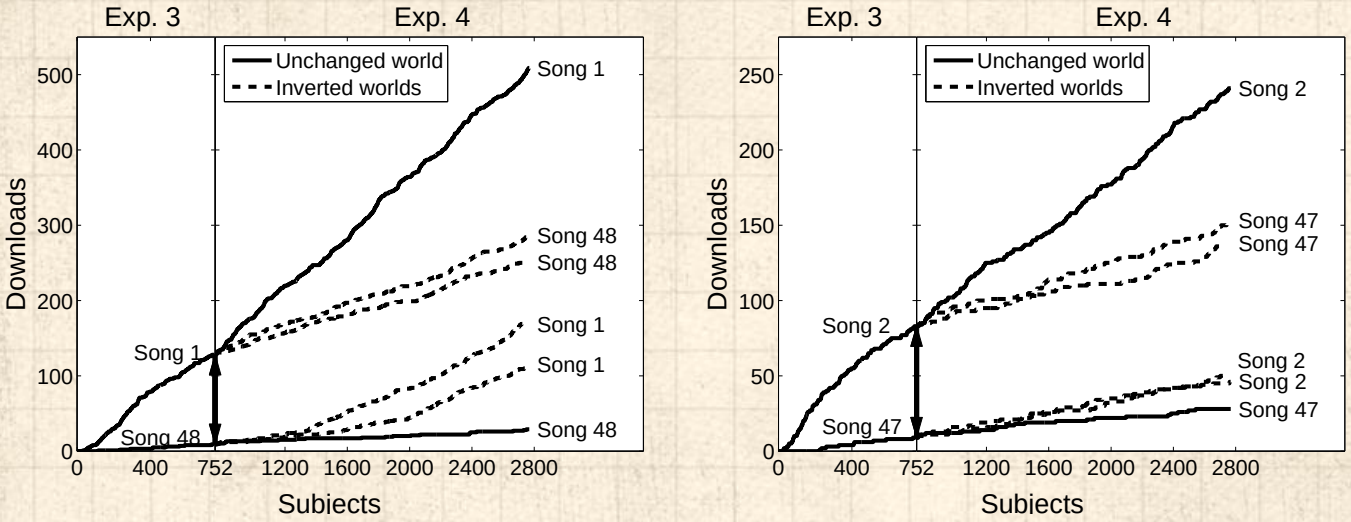


- Inversion of download count
- The pretend rich get richer ...

Music Lab Experiment—Sneakiness [7]



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

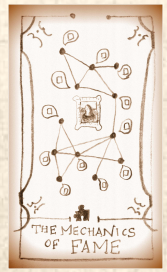
References I

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

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

[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

[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



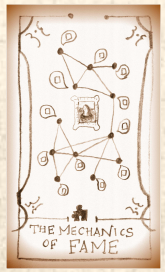
References II

[5] S. Rosen.
The economics of superstars.
Am. Econ. Rev., 71:845–858, 1981. pdf

[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

[7] M. J. Salganik and D. J. Watts.
Leading the herd astray: An experimental study of self-fulfilling prophecies in an artificial cultural market.
Social Psychology Quarterl, 71:338–355, 2008. pdf

[8] C. R. Sunstein.
Infotopia: How many minds produce knowledge.
Oxford University Press, New York, 2006.



References III

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