Voting, Success, and Superstars

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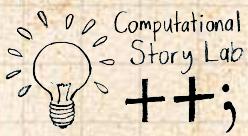
CSYS/MATH 300, Fall, 2015 | #FallPoCS2015

Prof. Peter Dodds | @peterdodds

Dept. of Mathematics & Statistics | Vermont Complex Systems Center
Vermont Advanced Computing Core | University of Vermont



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What's the Story?

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Winning: it's not for everyone
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Outline

Winning: it's not for everyone
Superstars
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References

Winning: it's not for everyone

- Superstars
- Musiclab

References

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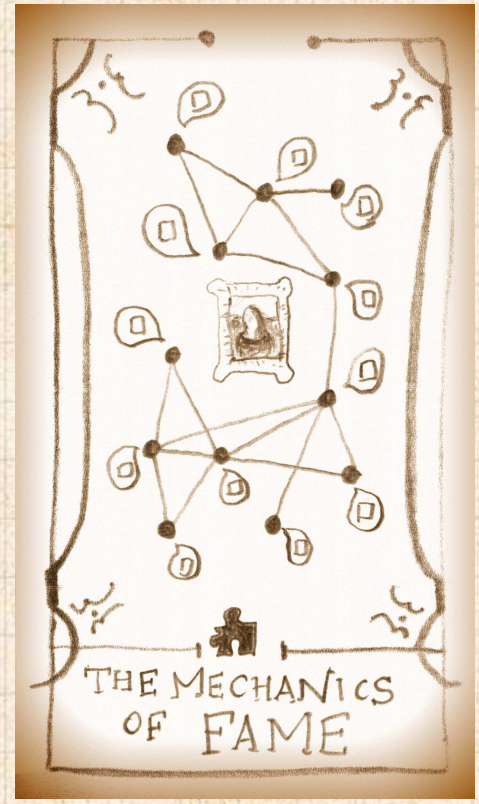
Superstars
Musiclab

References



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Superstars
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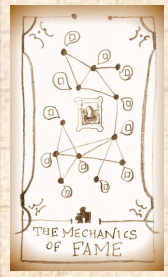
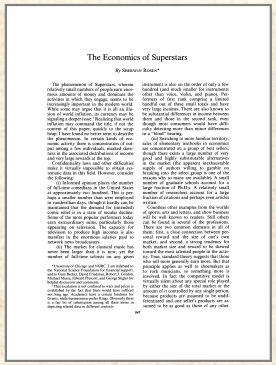


Where do superstars come from?


The Economics of Superstars

By Sherwin Rosen*

The phenomenon of Superstars, wherein relatively small numbers of people earn enormous amounts of money and dominate the activities in which they engage, seems to be commonplace in sports, entertainment, and the arts. While some may argue that it is all an illusion of world inflation, in currency may be, there are enough examples of astronomical salaries to more than command the title, if not the moment of this paper, quickly to the savage critic. The object of this paper is to analyze the phenomenon. In certain kinds of economic activity there is concentration of output among a few of the participants, and associated with this is the associated distribution of income and very large rewards at the top.

Before proceeding, some definitional difficulties make it virtually impossible to obtain systematic data in this field. However, consider the following:

1. The highest annual earnings figures for members of full-time comedians in the United States are approximately two hundred. This is perhaps a smaller number than were employed in vaudeville a generation ago, but it must be maintained that the demand for [unreadable] comic relief is in a state of secular decline. Even so, there are many more who perform with more extraordinary talent, particularly those appearing on television. The capacity for earnings is enormous. Johnny Carson's salary is reputed to be enormous relative gold to network news broadcasters.

2. The number of full-time classical music performers [unreadable] larger than it is now, yet the number of full-time soloists on any given

instrument is also on the order of only a few hundred (and much smaller for instruments other than voice, violin, and piano). Performers of this rank command a limited number of concerts per year, but they receive very large incomes. There are also known to be substantial differences in income between those who are "good" and those who are "best," though most consumers would have difficulty detecting more than minor differences in the performances.

3. On thinking in more familiar territory, sales of elementary textbooks in economics are enormous relative to the number of users, though there exists a large number of very good and highly substitutable alternatives for any one book. Here, too, the economies of supply of authors selling to gamble on breaking into the select group is one of the reasons why so many are available. A small number of authors receive royalties from a very large fraction of Ph.D.s. A relatively small number of researchers account for a large fraction of citations and perhaps even articles published.

Countless other examples from the worlds of sports, arts and letters, and show business can be listed. Several common elements can be found in several of the professions. There are two common elements in all of these. The first is imperfect talent, both perceived reward and the size of reward, even market; and second, a strong tendency for rewards to be highly concentrated on those toward the most talented people in the activity. Then, standard theory suggests that those who are slightly superior in talent to the next principle applies as well to shortstops as to rock musicians, or something more is involved. In fact the competitive model is wrench alien about any special role played by the "star" in the success of a project. The amount of it controlled by any single person, because products are assumed to be readily reproducible, and because the services are assumed to be as good as those of any other

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

Examples:

- Full-time Comedians (≈ 200)
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Superstars
Musiclab
References

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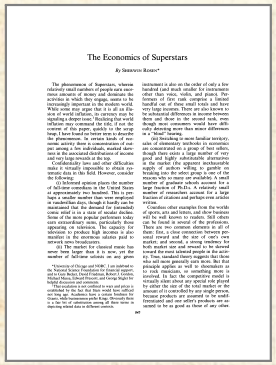
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The phenomenon of Superstars, wherein relatively small numbers of people earn enormous amounts of money and dominate the activities in which they engage, seems to be commonplace in sports, entertainment, and the arts. While some may argue that it is all an illusion of world inflation, in currency may be the most inflationary force in the world today, and inflation may command the title, if not the moment of this paper, quickly to the savage ills of which it is the cause and the effect. But the phenomenon, in certain kinds of economic activity there is concentration of output and talent among the few that is far greater than seen in the associated distributions of income and very large rewards at the top.

Some of the reasons for these difficulties make it virtually impossible to obtain systematic data in this field. However, consider the following:

In baseball, the second greatest player-hit number of full-time comedians in the United States is approximately two hundred. This is perhaps a smaller number than were employed in baseball a generation ago. It is frequently maintained that the demand for [unreadable] comic relief is in a state of secular decline. Yet there are a few entertainers who command enormous sums, particularly those appearing on television. The capacity for television to greatly magnify the number of monthly in the enormous salaries paid to network news broadcasters.

Or, the number of professional music has never been larger than it is now, yet the number of full-time soloists on any given instrument is also on the order of only a few hundred (and much smaller for instruments other than voice, violin, and piano). Performers of this rank command a limited supply of services, and they receive very large incomes. There are also known to be substantial differences in income between those who are at the top and the rest, although most consumers would have difficulty detecting more than minor differences in the performances.

Any Switching to more familiar territory, sales of elementary textbooks in economics are dominated by a few authors. Even though there exists a large number of very good and highly substitutable alternatives in the market, the total number of adoptions, sample of authors selling to gamble on breaking into the select group is one of the reasons why so many are available. A small number of economists account for a large fraction of citations and perhaps even articles published.

Countless other examples from the worlds of sports, arts and letters, and show business can be found. The common element in each can be found in several of the professions. There are two common elements in all of these. One is the concentration of talent, natural reward and the size of today's own market; and second, a strong tendency for winner-take-all markets to arise in the pursuit toward the most talented people in the activity. Then, standard theory suggests that those who are slightly superior in talent will receive a disproportionate reward, as well as shareholders in rock musicians, or something more is involved. In fact the competitive model is wrench alone about any special role played by the size of the market, the fact that the amount of it controlled by one single person, because products are assumed to be traded in perfect markets where all units are considered to be as good as those of any other.

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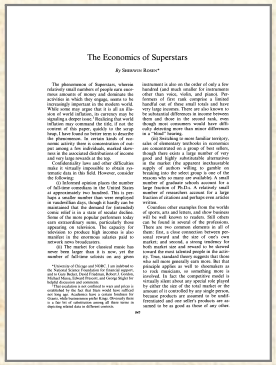

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Two difficulties make it virtually impossible to obtain systematic data in this field. However, consider the following:

Although the natural gestation process for the number of full-time comedians in the United States is approximately two hundred. This is perhaps a smaller number than were employed in vaudeville alone in 1929. Nevertheless, it is maintained that the demand for [illegible] comic relief is in a state of secular decline. Only a few of the survivors command [illegible] earn extraordinary rents, particularly those appearing on television. The capacity for [illegible] is the enormous salaries paid to comedians in the enormous salaries paid to network news broadcasters.

Again, the number of professional music has been larger than it is now, yet the number of full-time soloists on any given

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[illegible] instrument is also on the order of only a few hundred (and much smaller for instruments other than voice, violin, and piano). Performers of this rank command a limited market, but within that market they can earn very large incomes. There are also known to be substantial differences in income between the top violinist and the top violinist, although most consumers would have difficulty detecting more than minor differences in their performances.

Any [illegible] to most familiar territory: sales of elementary textbooks in economics are dominated by a few authors. Even though there exists a large number of very good and highly substitutable alternatives in the market, the demand for any one author's supply of services selling to gamble on breaking into the select group is one of the reasons why so many are available. A small [illegible] of economists account for a large fraction of citations and perhaps even articles published.

Countless other examples from the worlds of sports, arts and letters, and show business can be found. The common element in each can be found in several of the professions. There are two common elements in all of these. First, relatively small numbers of people stand toward and the size of each's own market; and second, a strong tendency for those who do stand toward the very top to receive [illegible] toward the most talented people in the society. Thus, standard theory suggests that [illegible] the principle applies as well to shortstops as to rock musicians, or something more is involved. In fact the competitive model is [illegible] arises almost any special role played by the fact that the total demand for the services of [illegible] is controlled by one single person, because products are assumed to be traded in impersonal markets where each seller is assumed to be as good as those of any other.

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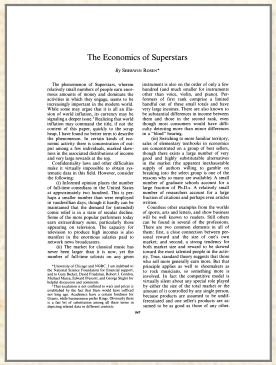
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Concentration and inequality of this kind make it virtually impossible to obtain systematic data in this field. However, consider the following:

1. In 1970 the annual income figures for members of full-time committees in the United States all approximately two hundred. This is perhaps a smaller number than were employed in this capacity fifty years ago. It is probably safe to maintained that the demand for [illegible] committees relied is in a state of secular decline. Yet there are a few individuals in this profession who earn extraordinary sums, particularly those appearing on television. The capacity for television to greatly magnify the talents of a few members in the enormous salaries paid to network news broadcasters.

2. In 1970 the number of theatrical events has never been larger than it is now, yet the number of full-time salaries on any given

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[illegible] instrument is also on the order of only a few hundred (and much smaller for instruments other than voice, violin, and piano). Performances of live rock companies a limited number of times per year, yet a few of them earn very large incomes. There are also known to be substantial differences in income between the top violinist and the next best violinist, although most consumers would have difficulty detecting more than minor differences.

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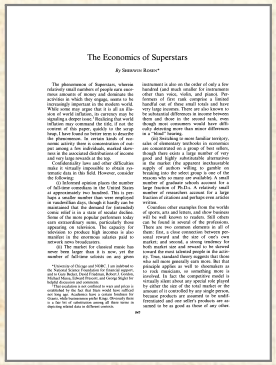
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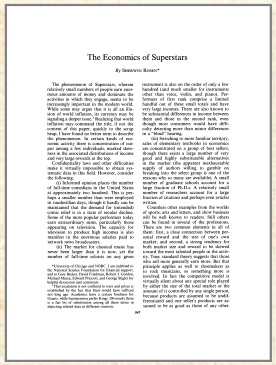

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Economists have found these difficulties make it virtually impossible to obtain systematic data in this field. However, consider the following:

In 1970 the total earned income of full-time comedians in the United States, of approximately two hundred. This is perhaps a smaller number than were employed in baseball, football, and basketball. It is also maintained that the demand for [illegible] comic relief is in a state of secular decline. Yet there are many more comedians working in more extraordinary roles, particularly those appearing on television. The capacity for laughter is limited, and the total number of comedies in the economic relation paid to network news broadcasters.

Or, in 1970 the total estimated music business was larger than it is now, yet the number of full-time soloists on any given

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[illegible] instrument is also on the order of only a few hundred (and much smaller for instruments other than voice, violin, and piano). Performances of live rock comprise a limited number of hours each year, yet some stars enjoy very large incomes. There are also known to be substantial differences in income between top lawyers, doctors, and other professionals, though most consumers would have difficulty detecting more than minor differences in the skills involved.

Any [illegible] in most familiar territory: sales of elementary textbooks in economics are concentrated in the hands of a few titles, though there exists a large number of very good and highly substitutable alternatives from which to choose. Moreover, the relative supply of authors willing to gamble on breaking into the select group is one of the reasons why so many are available. A small number of economists account for a large fraction of the Ph.D.s. A relatively small number of researchers account for a large fraction of citations and perhaps even articles published.

Countless other examples from the worlds of sports, arts and letters, and show business can be found in several of the professions. There are two common elements in all of these. First, relatively small differences in natural reward and the size of rewards in the market; and second, a strong tendency for winner to take all or most of the rewards going toward the most talented people in the activity. Thus, standard theory suggests that [illegible] the same principles apply as well to shortstops as to rock musicians, or something more is involved. In fact the competitive model is [illegible] wherein above any special role played by talent, the size of the market and the amount of it controlled by any single person, because products are assumed to be traded [illegible] and because all units of talent are assumed to be as good as those of any other

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- Economic Textbooks (the usual myopic example)

- Highly skewed distributions again...

Superstars

Rosen's theory:

- Individual quality q maps to reward $R(q)$.
- $R(q)$ is 'convex' ($\mathrm{d}^2 R/\mathrm{d}q^2 > 0$).
- Two reasons:
  1. Imperfect substitution.
  2. Technology.
- Joint consumption versus public good.
- No social element—success follows 'inherent quality'.

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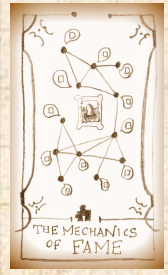
Superstars
Musiclab
References



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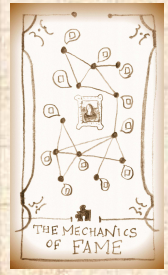

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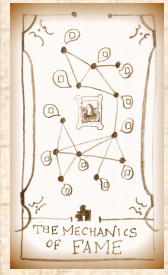

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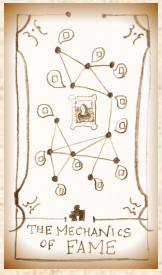

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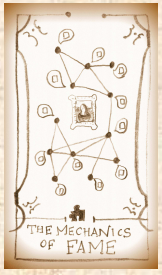

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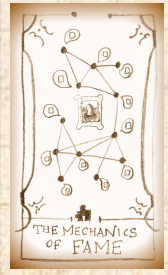

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Rosen's theory:

- Individual quality q maps to reward $R(q)$.
- $R(q)$ is 'convex' ($\mathrm{d}^2 R/\mathrm{d}q^2 > 0$).
- 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.
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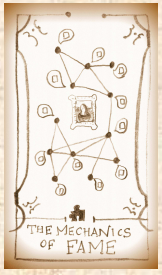

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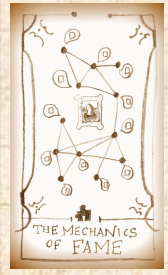

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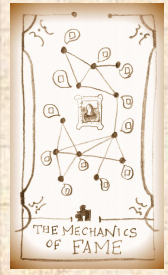

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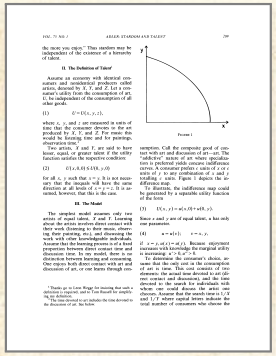

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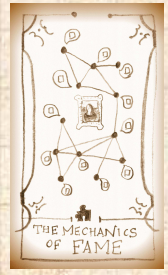

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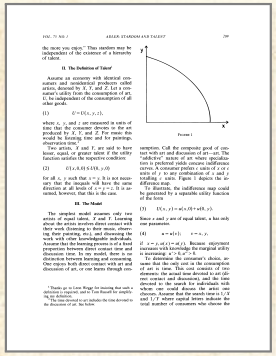

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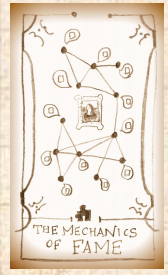

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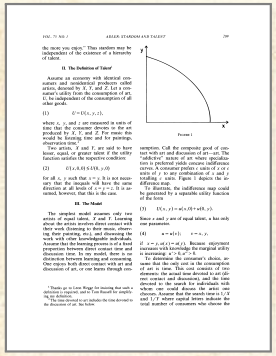

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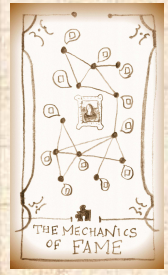

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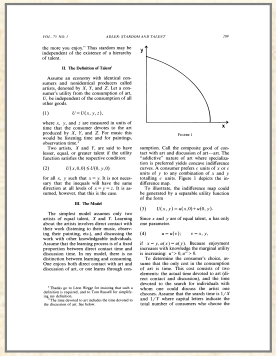

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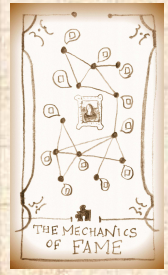

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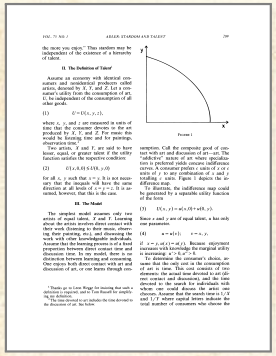

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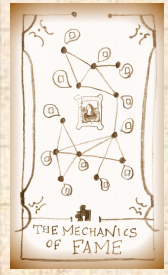

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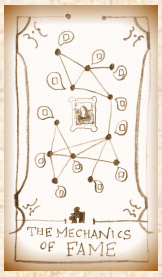
Evidence from the web suggestions (Huberman et al.)

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:

A theory of measuring, electing, and ranking

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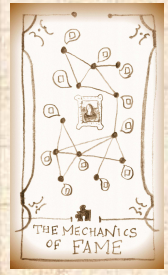
Balinski and Laraki, Proc. Natl. Acad. Sci., **104**, 8720–8725, 2007. [2]



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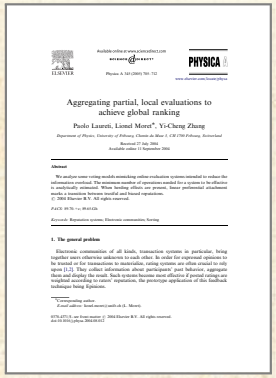
Aggregating partial, local evaluations to achieve global ranking

Paolo Laureti, Lionel Moret*, Yi-Cheng Zhang

"Aggregating partial, local evaluations to achieve global ranking"

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- Model: participants rank n objects based on underlying quality q
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$$p_i(t) \propto v_i(t)^\alpha \text{ or } p_i(t) \propto q_i v_i(t)^\alpha.$$

- If $\alpha < 1$, correct quality ordering is uncovered
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- Related to Adler's approach

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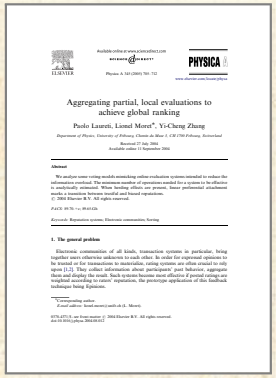
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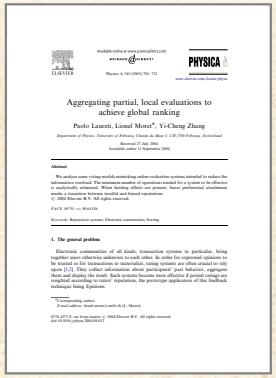

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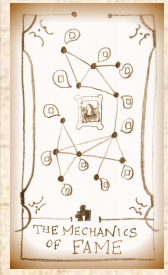

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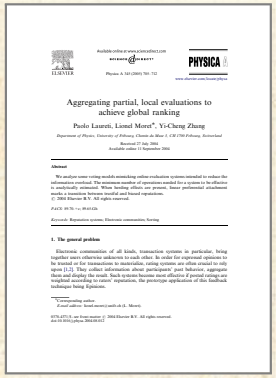

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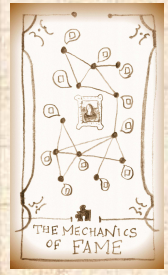

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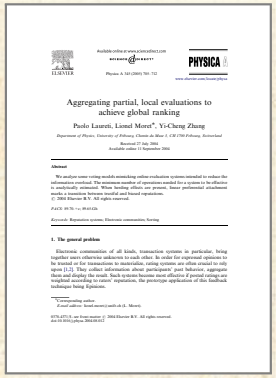

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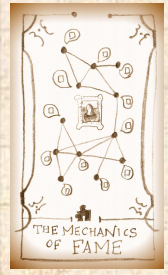

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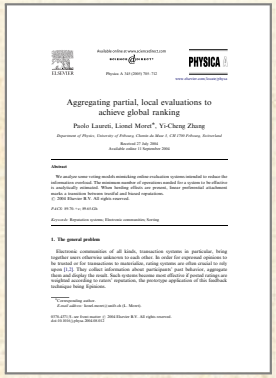

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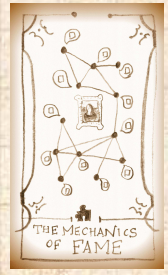

Dominance hierarchies

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

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Chase et al.,
Proc. Natl. Acad. Sci., **99**, 5744-5749, 2002. [3]

- The aggressive female Metriaclima zebra:

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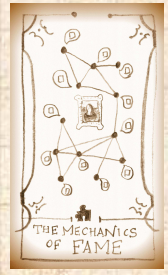
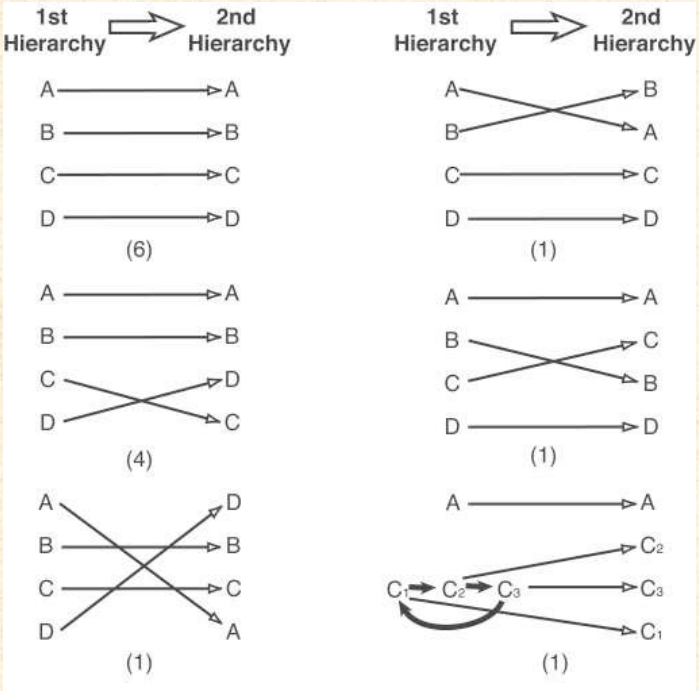
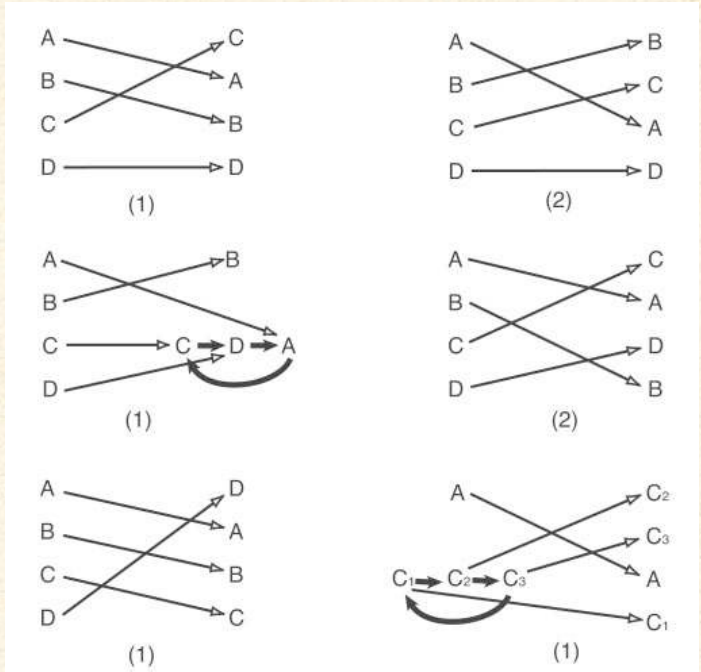


Dominance hierarchies

Fish forget—changing of dominance hierarchies:





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

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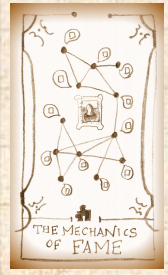

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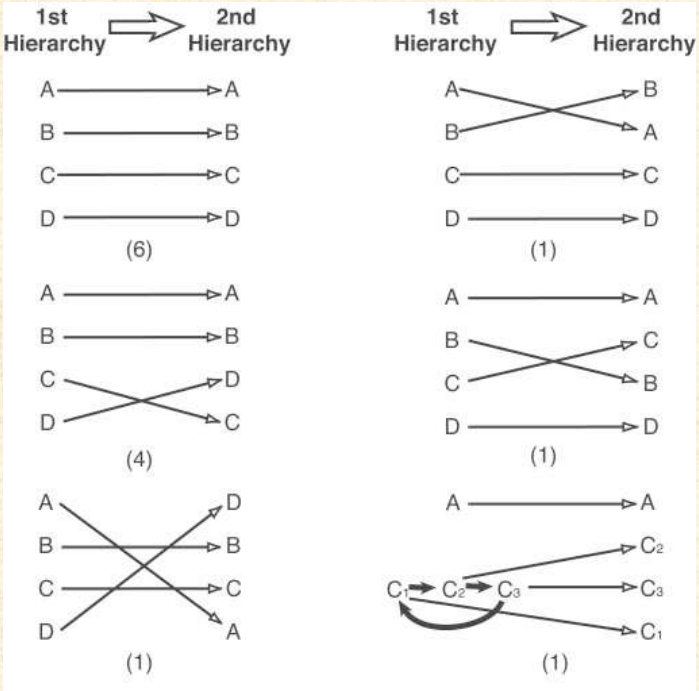

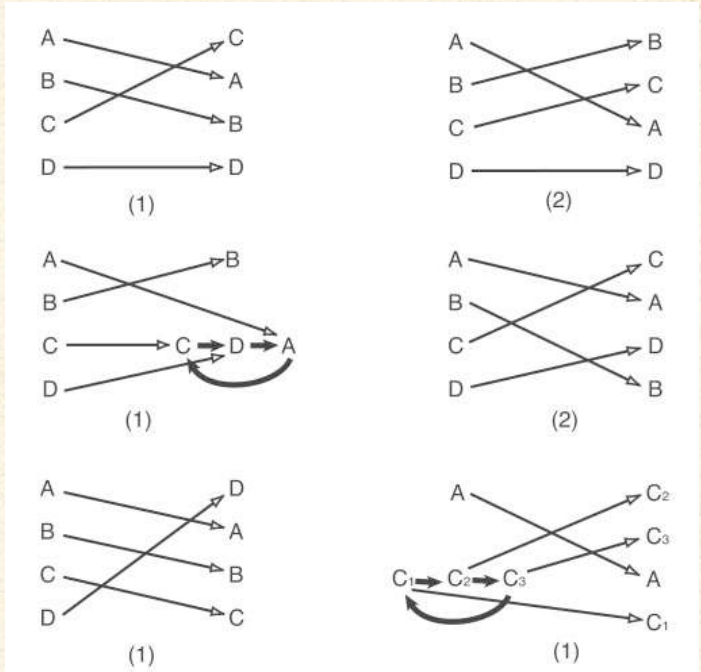

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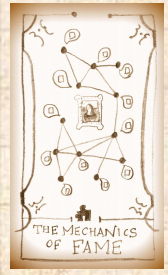

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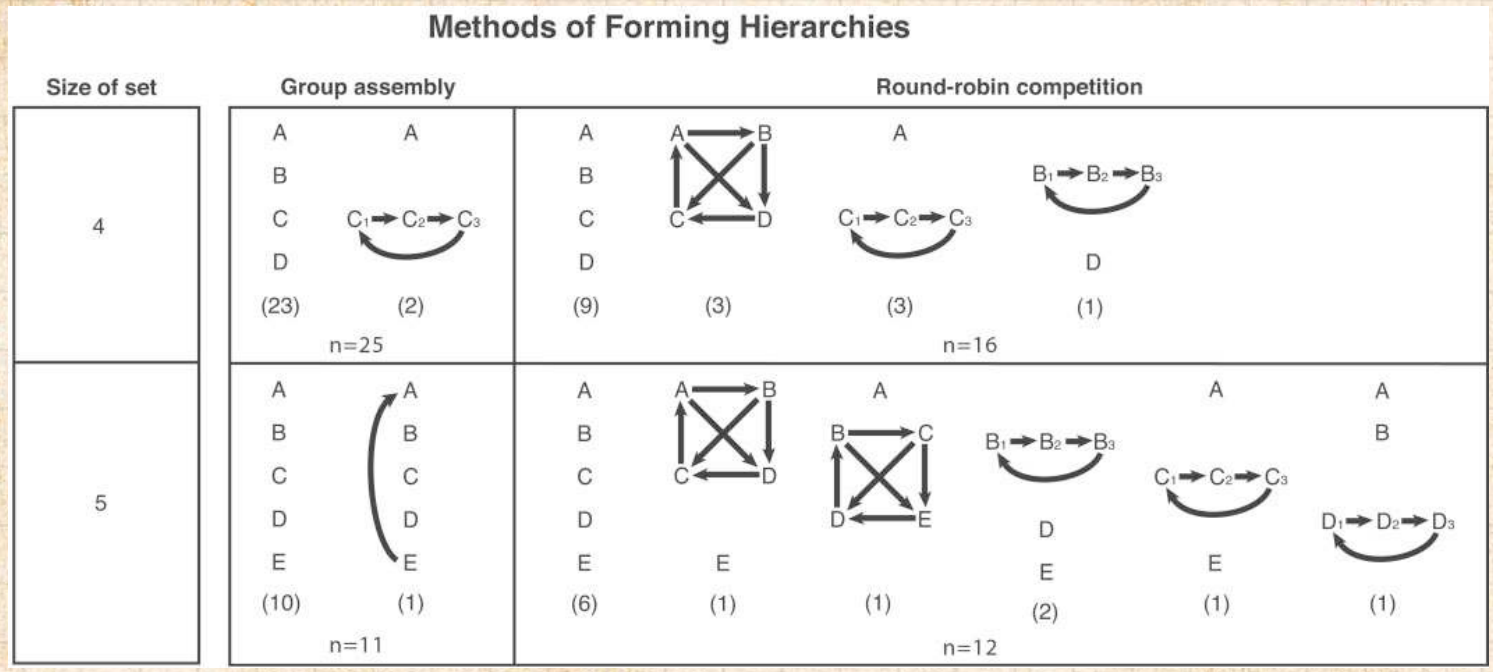

- Group versus isolated interactions produce different hierarchies

Outline

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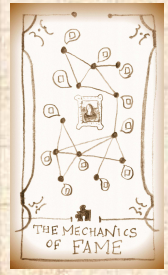

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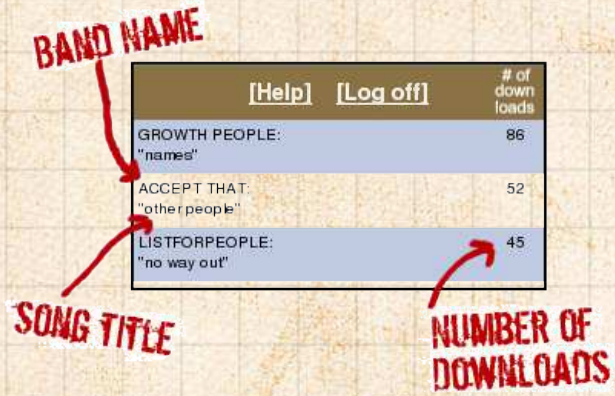
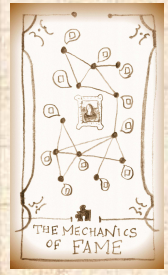


48 songs
30,000 participants

multiple 'worlds'
Inter-world variability

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



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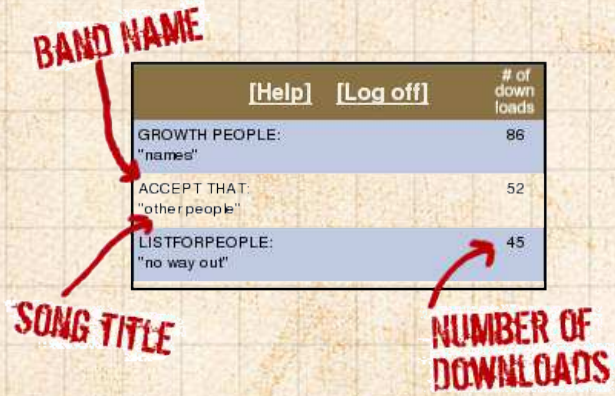

48 songs
30,000 participants

multiple 'worlds'
Inter-world variability

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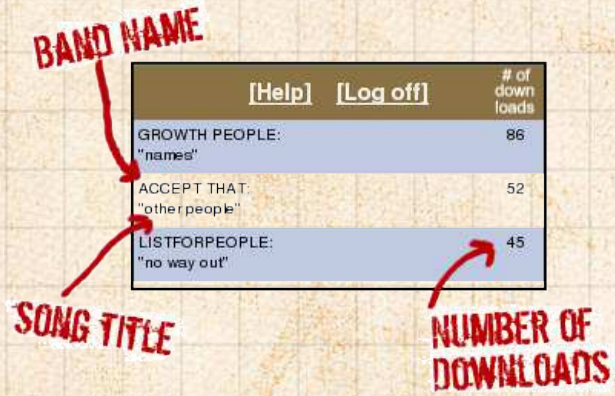

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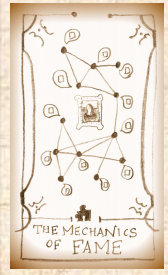

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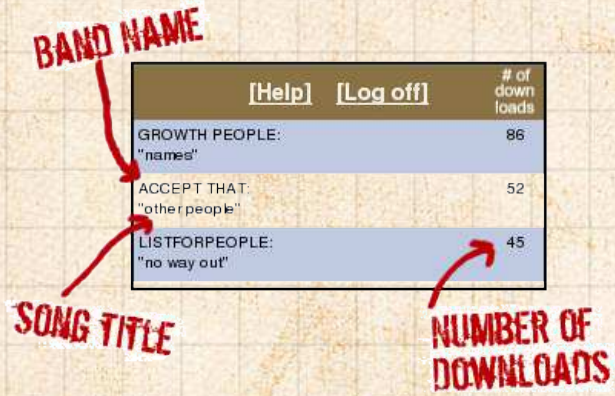

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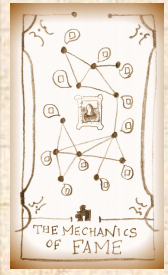

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Music Lab – Song Selection - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

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

[Help] [Log off]

	# of down loads		# of down loads		# of down loads
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]

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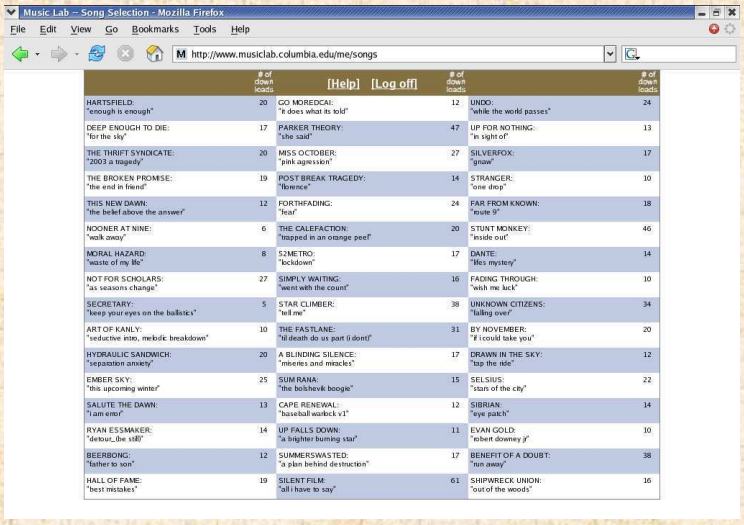
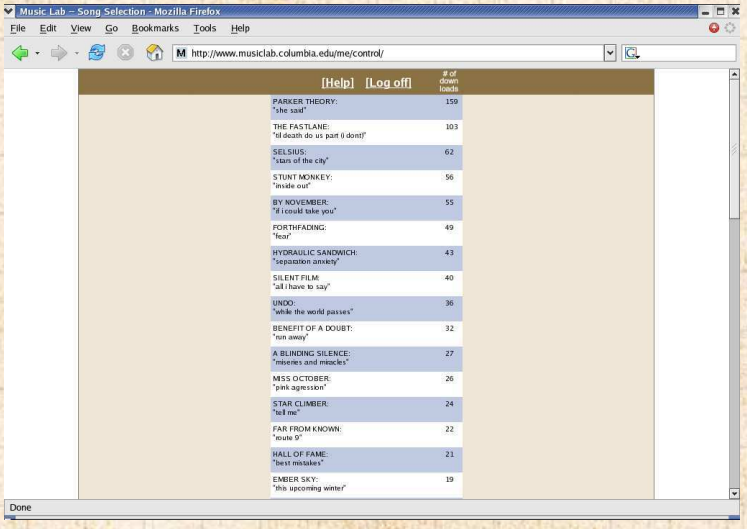
Experiment 1



Experiments 2–4



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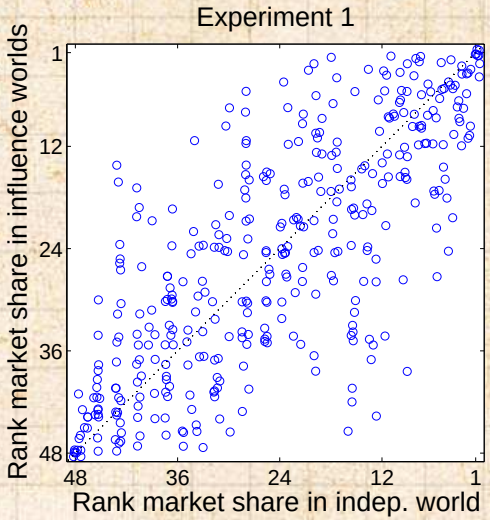

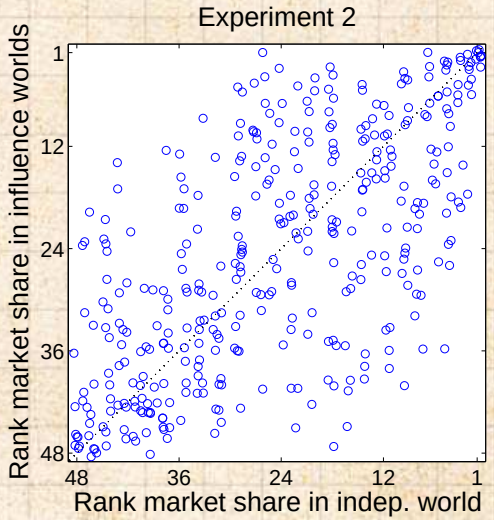

- Variability in final rank.

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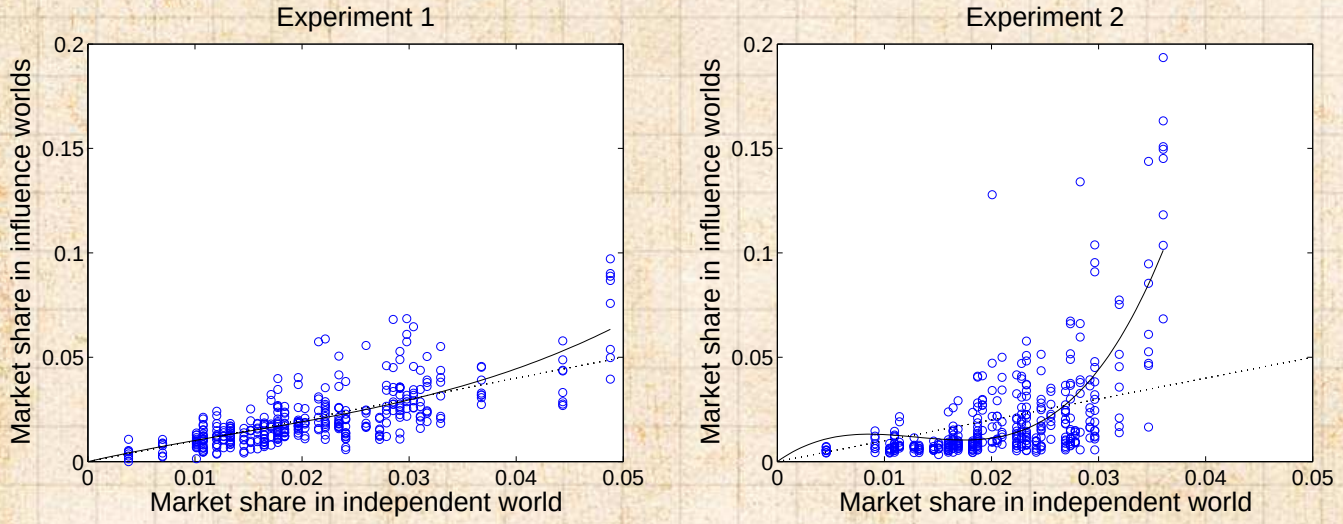

- Variability in final number of downloads.

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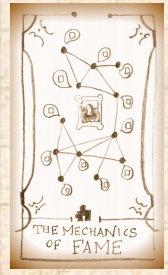
- Inequality as measured by Gini coefficient:

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



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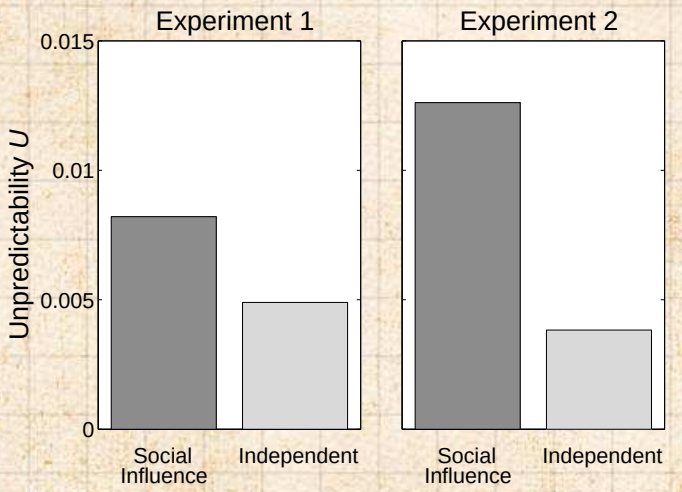
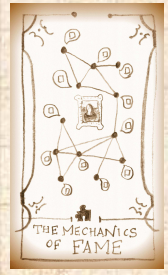


- Unpredictability

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



Music Lab Experiment

Sensible result:

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

Peculiar result:

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Very peculiar observation:

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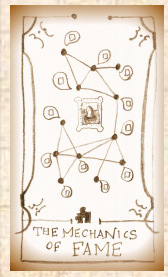

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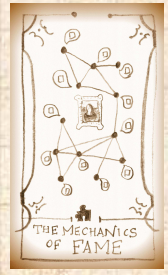

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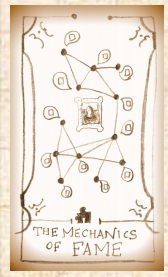

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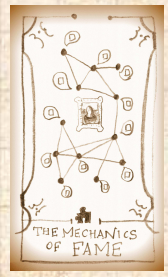

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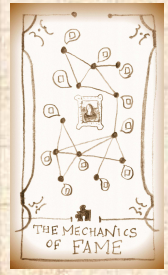

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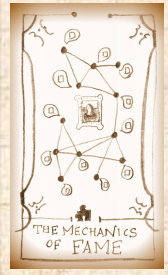

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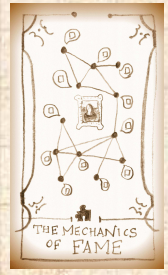

Music Lab Experiment—Sneakiness [7]

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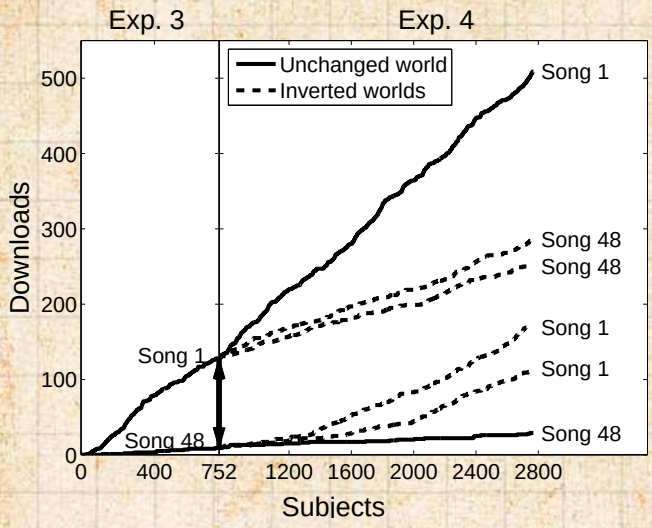

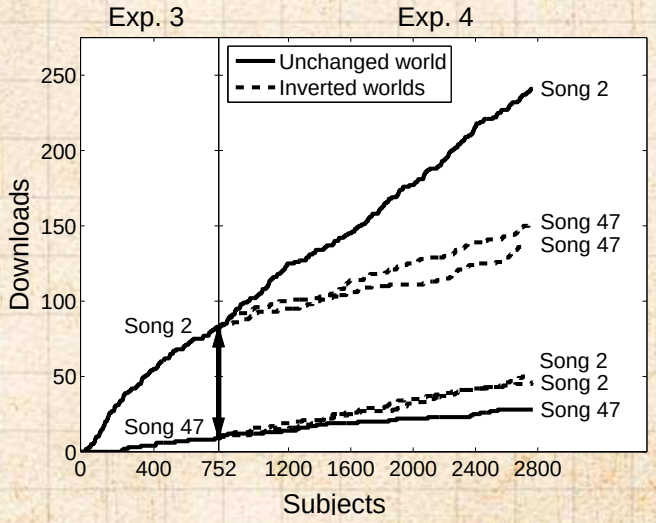

- Inversion of download count
- The pretend rich get richer ...
- ... but at a slower rate

Music Lab Experiment—Sneakiness [7]

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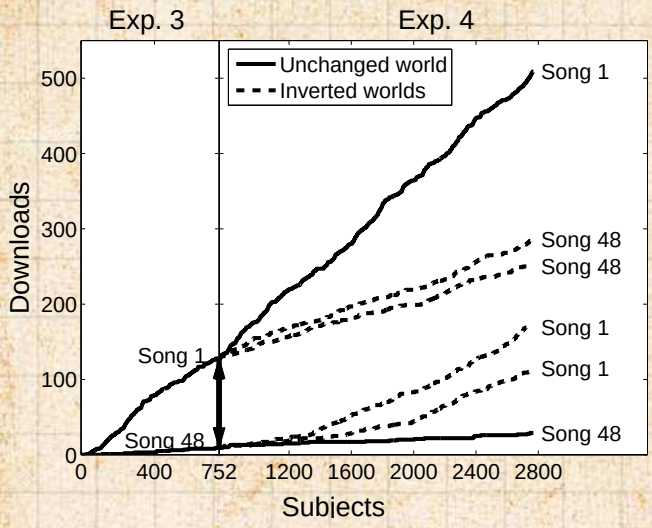

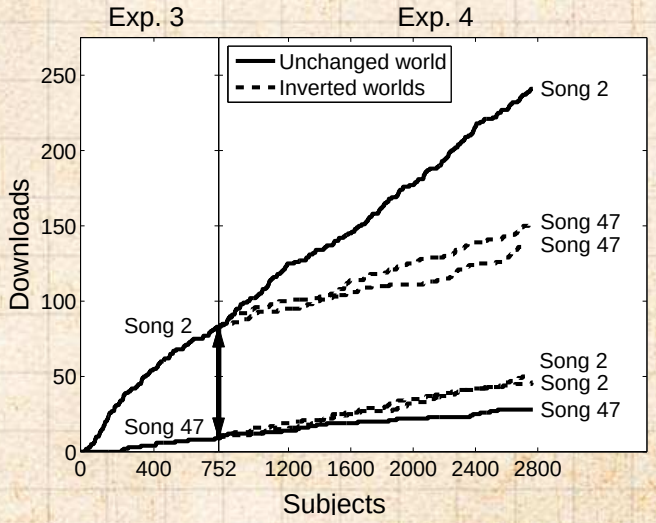

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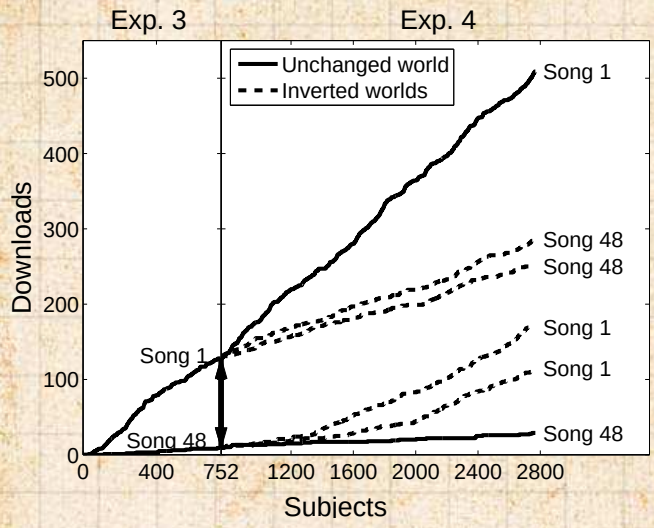

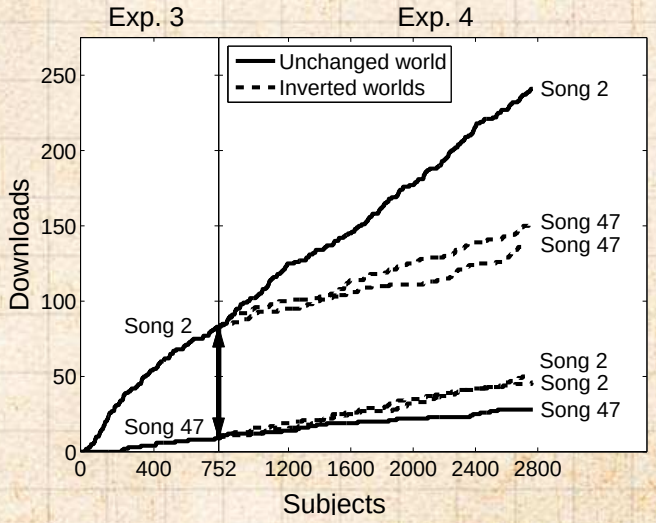

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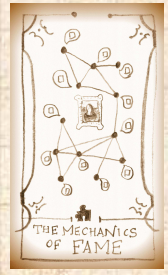

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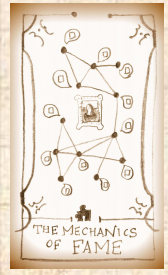

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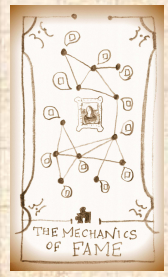
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