

The puzzling nature of success in cultural markets[★]

Matthew J. Salganik¹

Peter S. Dodds²

Duncan J. Watts^{3,4}

Is There a Physics of Society?

Santa Fe Institute

January 11, 2008

1: Dept. of Sociology & Office of Population Research, Princeton University

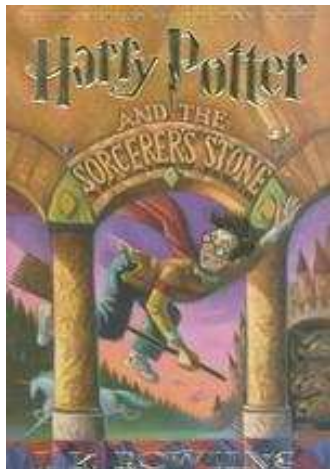
2: Dept. of Mathematics and Statistics, University of Vermont

3: Dept. of Sociology, Columbia University

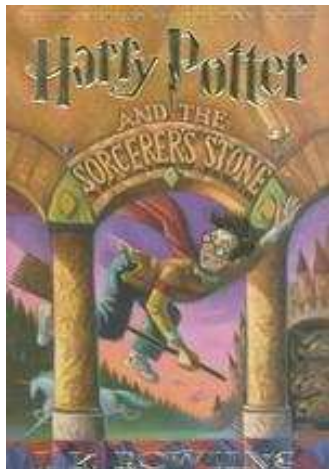
4: Yahoo! Research

★ Research supported by National Science Foundation, James S. McDonnell Foundation, and Institute for Social and Economic Research and Policy at Columbia University.

The Harry Potter puzzle



The Harry Potter puzzle



- ▶ Wild success.
- ▶ Rejected by eight publishers.

This seems like a strange combination.

The puzzle of cultural markets

The Harry Potter story illustrates puzzling nature of success for cultural objects (books, movies, piece of art, music)

- ▶ **extreme inequality in the success of objects**

(Rosen, 1981; Frank and Cook, 1995)

Extreme inequality suggest that “the best” are different from “the rest”

The puzzle of cultural markets

The Harry Potter story illustrates puzzling nature of success for cultural objects (books, movies, piece of art, music)

- ▶ **extreme inequality in the success of objects**

(Rosen, 1981; Frank and Cook, 1995)

Extreme inequality suggest that “the best” are different from “the rest”

- ▶ **unpredictability in the success of objects**

Qualitative: (Peterson and Berger, 1971; Hirsch, 1972; Denisoff, 1975)

Quantitative: (De Vany and Walls, 1999; Vogel, 2004)

“Nobody knows anything” – William Goldman

Previous research, unpredictability of success

Previous work on unpredictability, mostly by sociologists in the “production of culture” school

- ▶ **Organization forms**

(Peterson and Berger, 1971; Hirsch, 1972; Faulkner and Anderson, 1987)

- ▶ **Discourse strategies**

(Bielby and Bielby, 1994)

→ This work explores the *consequences* on unpredictability but not its *causes*

Previous research, inequality of success

Previous research on inequality of success, mostly done by economists

- ▶ **Empirical description of success distribution**
(Chung and Cox, 1994; Vogel, 2004; Krueger, 2005; many others)
- ▶ **Theoretical models**
(Rosen, 1981; Adler, 1985; De Vany and Walls, 1996)

→ This work “explains” inequality, but not unpredictability

Proposed solution to the puzzle of cultural markets

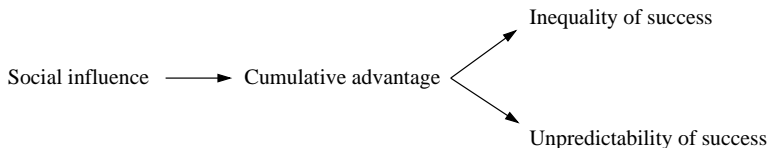
Want to unify these two streams with one common explanation.

Psychological explanation:

People agree on what's good, but people are hard to predict

Sociological explanation:

The collective outcomes of inequality and unpredictability of success both arise from an individual-level process of social influence



Social influence

Individual's choices in cultural markets are influenced by the behavior of others

- ▶ Too many objects to consider so we use others' behavior as a shortcut
- ▶ Desire for compatibility (we want to be able to talk to others)
- ▶ Conformity pressure

Cumulative advantage

Cumulative advantage: success causes more success

“Matthew” effect, rich-gets-richer, preferential attachment, etc.

Cumulative advantage literature can be divided into two groups

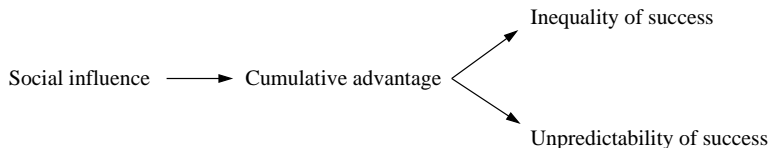
- ▶ **Inequality**

(Simon, 1955; Price, 1965; Merton, 1968; Barabási and Albert, 1999)

- ▶ **Unpredictability**

(David, 1985; Arthur, 1989; Granovetter, 1998)

Testing the model



Problems with observational data:

- ▶ don't know what would have happened without social influence
- ▶ can't see multiple “histories” to observe unpredictability

Testing the model

Instead of using observational data we are going to run an experiment because

- ▶ can run the same process multiple times under exactly the same conditions, allows us to see multiple “histories”
- ▶ can control the information that people have about the behavior of others

But, this experiment is different from most,

- ▶ experiments in psychology and economics have **individual** as unit of analysis, require **hundreds** of participants
- ▶ these sociological experiments have **collective outcome** as unit of analysis, require **thousands** of participants

Web-based experiment allow for such large sample sizes because each additional participant has no cost (total $n = 27,267$)

The experiment



The experiment

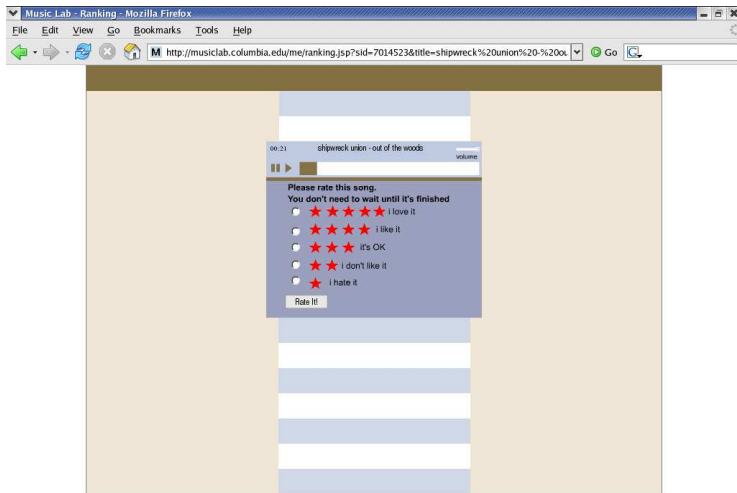
Music Lab – Song Selection - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

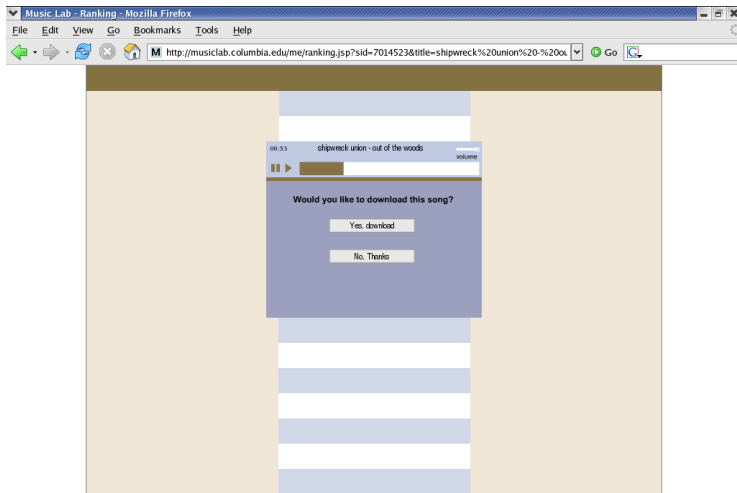
http://www.musiclab.columbia.edu/me/songs

	# of down loads	[Help] [Log off]	# of down loads	# of down loads	
HARTSFIELD: "enough is enough"	20	GO MOREDCAL: "it does what its told"	12	UNDO: "while the world passes"	24
DEEP ENOUGH TO DIE: "for the sky"	17	PARKER THEORY: "she said"	47	UP FOR NOTHING: "in sight of"	13
THE THRIFT SYNDICATE: "2003 a tragedy"	20	MISS OCTOBER: "pink aggression"	27	SILVERFOX: "gnaw"	17
THE BROKEN PROMISE: "the end in friend"	19	POST BREAK TRAGEDY: "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	S2METRO: "lockdown"	17	DANTE: "hes mystey"	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: "talking 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 emo"	13	CAPE RENEWAL: "baseball warbeck v1"	12	SIBRIAN: "eye patch"	14
RYAN ESSMAKER: "detour...the 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

The experiment



The experiment



The experiment

Music Lab - Song Selection - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

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

	# of down loads	[Help] [Log off]	# of down loads	# of down loads	
HARTSFIELD: "enough is enough"	20	GO MOREDCAL: "it does what its told"	12	UNDO: "while the world passes"	24
DEEP ENOUGH TO DIE: "for the sky"	17	PARKER THEORY: "she said"	47	UP FOR NOTHING: "in sight of"	13
THE THRIFT SYNDICATE: "2003 a tragedy"	20	MISS OCTOBER: "pink aggression"	27	SILVERFOX: "gnaw"	17
THE BROKEN PROMISE: "the end in friend"	19	POST BREAK TRAGEDY: "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	S2METRO: "lockdown"	17	DANTE: "hes mystey"	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: "talking over"	34
ART OF KANLY: "seductive emo, 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 emo"	13	CAPE RENEWAL: "baseball warbeck v1"	12	SIBRIAN: "eye patch"	14
RYAN ESSMAKER: "detour...the 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

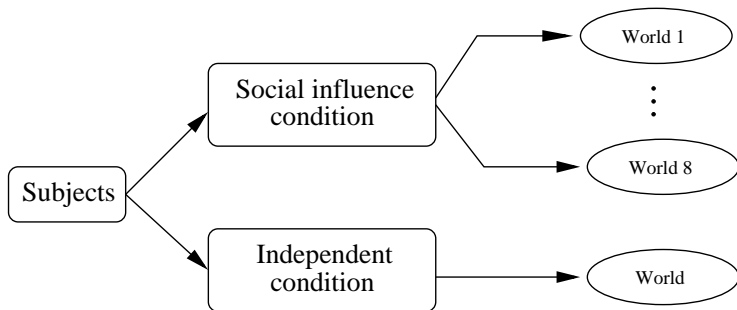
The experimental design

As participants arrive, they are randomly assigned into one of two conditions

- ▶ **Independent:** See the names of bands and songs
- ▶ **Social influence:** See the names of bands, songs, and number of previous downloads

In addition, social influence condition divided into eight “worlds” and people only see the downloads of previous participants in their world

The experimental design



Overall study plan

	Participants	
	http://www.bolt.com	E.S.W.E.
Weaker signal	Experiment 1 ($n = 7,149$)	
Stronger signal	Experiment 2 ($n = 7,192$)	Experiment 3 ($n = 2,930$)
Deception signal		Experiment 4 ($n = 9,996$)

Experiment 1: Overview

October 7, 2004 to December 15, 2004 – 69 days

Design: 8 social influence worlds, 1 independent world

Summary statistics:

- ▶ 7,149 participants
- ▶ 27,365 listens
- ▶ 8,203 downloads

Participants drawn mostly from <http://www.bolt.com>

Experiment 1: Screenshots

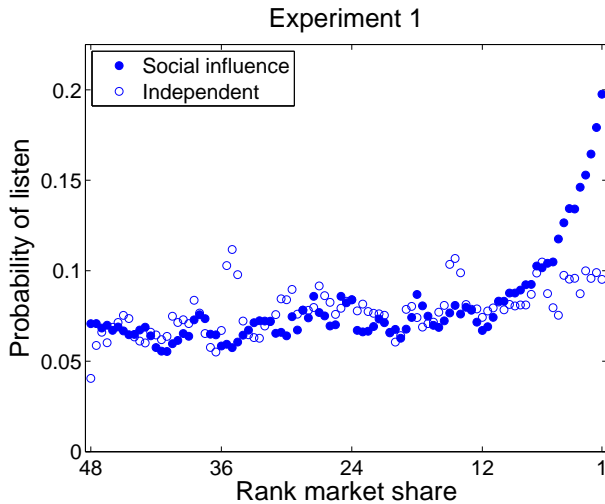
Movie	Year	Director	Genre	Rating	Link
HARTFORD	20	JOHN HURT	12	12	12
THE GODFATHER	19	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART II	1974	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART III	1978	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART IV	1981	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART V	1984	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART VI	1987	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART VII	1990	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART VIII	1993	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART IX	1996	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART X	1999	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART XI	2002	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART XII	2005	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART XIII	2008	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART XIV	2011	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART XV	2014	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART XVI	2017	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART XVII	2020	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART XVIII	2023	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART XIX	2026	FRANCOIS TRUFFAUT	12	12	12
THE GODFATHER PART XX	2029	FRANCOIS TRUFFAUT	12	12	12

(a) Social influence condition

[illegible]

(b) Independent condition

Experiment 1: Social influence



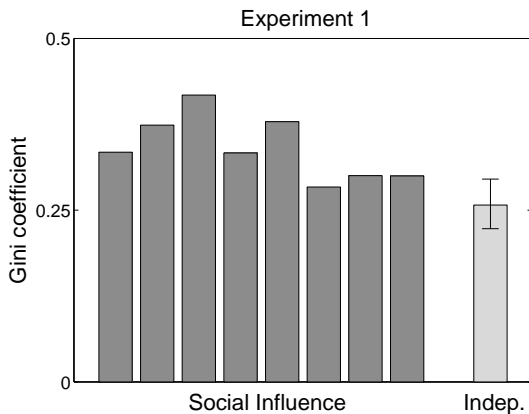
Experiment 1: Inequality in success

We measure the success of a song by its market share of downloads

We measure inequality in success using Gini coefficient

- ▶ common measure of inequality
- ▶ good theoretical characteristics
- ▶ range: 0 (total equality) to 1 (total inequality)

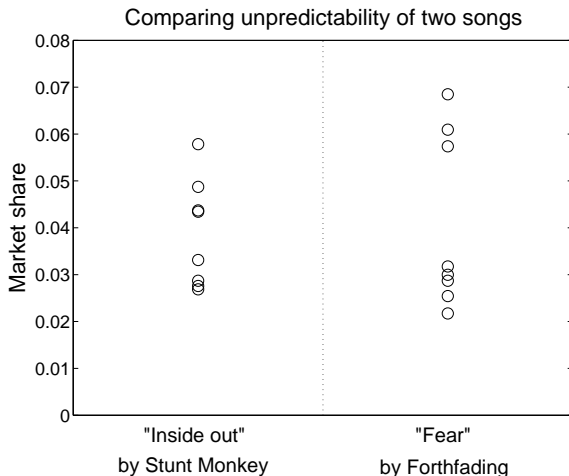
Experiment 1: Inequality in success



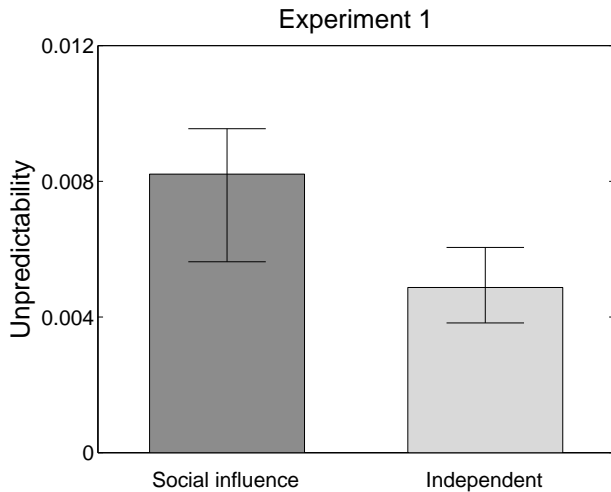
Experiment 1: Unpredictability

The more the results differ across realizations the more the results are unpredictable.

U = mean difference in market share across all pairs of realizations



Experiment 1: Unpredictability



Experiment 1: Conclusion

Social influence worlds showed:

- ▶ increased inequality in success
- ▶ increased unpredictability of success

Differences were statistically significant, but of modest magnitude.
What if we increase in the amount of social influence?

Overall study plan

	Participants	
	http://www.bolt.com	E.S.W.E.
Weaker signal	Experiment 1 ($n = 7,149$)	
Stronger signal	Experiment 2 ($n = 7,192$)	Experiment 3 ($n = 2,930$)
Deception signal		Experiment 4 ($n = 9,996$)

Experiment 1 and 2 screenshots

	Chapter	Chapter Length	Chapter Count
CHAPTER I	GO DOWNHILL "I am alone, and I am dead."	24	1/20
CHAPTER II	THE DECK "I am alone, and I am dead."	24	2/20
CHAPTER III	THE DECK "I am alone, and I am dead."	24	3/20
CHAPTER IV	THE DECK "I am alone, and I am dead."	24	4/20
CHAPTER V	THE DECK "I am alone, and I am dead."	24	5/20
CHAPTER VI	THE DECK "I am alone, and I am dead."	24	6/20
CHAPTER VII	THE DECK "I am alone, and I am dead."	24	7/20
CHAPTER VIII	THE DECK "I am alone, and I am dead."	24	8/20
CHAPTER IX	THE DECK "I am alone, and I am dead."	24	9/20
CHAPTER X	THE DECK "I am alone, and I am dead."	24	10/20
CHAPTER XI	THE DECK "I am alone, and I am dead."	24	11/20
CHAPTER XII	THE DECK "I am alone, and I am dead."	24	12/20
CHAPTER XIII	THE DECK "I am alone, and I am dead."	24	13/20
CHAPTER XIV	THE DECK "I am alone, and I am dead."	24	14/20
CHAPTER XV	THE DECK "I am alone, and I am dead."	24	15/20
CHAPTER XVI	THE DECK "I am alone, and I am dead."	24	16/20
CHAPTER XVII	THE DECK "I am alone, and I am dead."	24	17/20
CHAPTER XVIII	THE DECK "I am alone, and I am dead."	24	18/20
CHAPTER XIX	THE DECK "I am alone, and I am dead."	24	19/20
CHAPTER XX	THE DECK "I am alone, and I am dead."	24	20/20

(a) Experiment 1

[illegible]

(b) Experiment 2

Experiment 2: Amplifying the social signal

December 15, 2004 to March 8, 2005 – 83 days

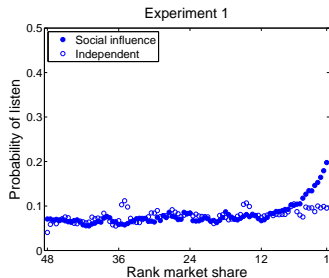
Design: 8 social influence worlds, 1 independent world

Summary statistics:

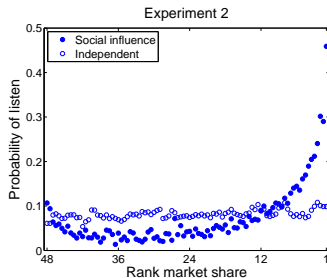
- ▶ 7,192 participants
- ▶ 25,860 listens
- ▶ 10,298 downloads

Participants drawn mostly from <http://www.bolt.com>

Experiment 1 and 2: Social influence



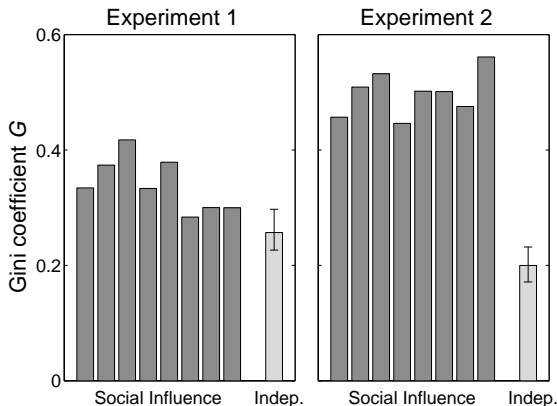
(a) Experiment 1, weaker signal



(b) Experiment 2, stronger signal

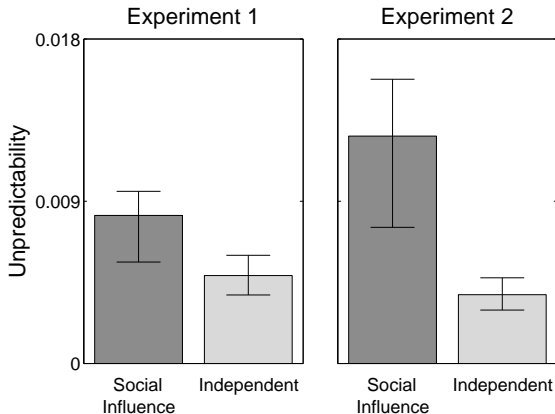
At the individual level social influence increased

Experiment 2: Inequality



Median Gini coefficient increases from 0.34 (France) to 0.50 (Nigeria)

Experiment 2: Unpredictability



Unpredictability increases by about 50%

Experiment 2: Conclusion

Experiments 1 and 2 show a dose-response relationship. Increasing the strength of social influence leads to

- ▶ increased inequality of success
- ▶ increased unpredictability of success

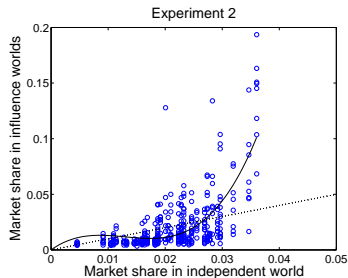
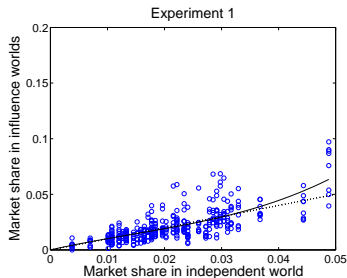
The role of appeal

What is the relationship between “quality” and success?

Hard to answer because “quality” of cultural objects is very hard (impossible?) to measure (Gans, 1974; Bourdieu, 1979; Becker, 1982; DiMaggio, 1987)

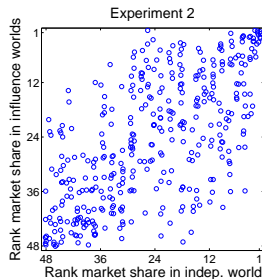
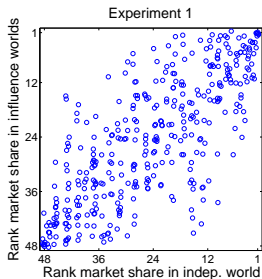
In these experiments we have an excellent measure of “appeal”: the market share of the songs in the independent condition

Relationship between appeal and success



Higher appeal songs tend to do better, but there is a lot of scatter

Relationship between appeal and success: ranks



Highest appeal songs never do terrible, lowest appeal never do great, any other result possible

Overall study plan

	Participants	
	http://www.bolt.com	E.S.W.E.
Weaker signal	Experiment 1 ($n = 7,149$)	
Stronger signal	Experiment 2 ($n = 7,192$)	Experiment 3 ($n = 2,930$)
Deception signal		Experiment 4 ($n = 9,996$)

Experiment 3

Experiment 3 was the same as experiment 2 except we used an older, more international, more educated population drawn from the electronic small world experiment (Dodds, Muhamad, and Watts, 2003).

At the aggregate-level, we observed similar levels of inequality and unpredictability. Therefore, these results appear to be relatively robust to the participant pool.

Self-fulfilling prophecies

In the first three experiments we let the success develop naturally. However, in real markets there are often cultural entrepreneurs trying to manipulate the perceived success of objects.

- ▶ David Vise bought and then returned 17,000 copies of his book “The Bureau and the Mole”

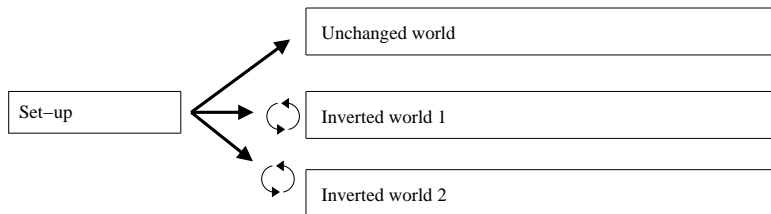
Self-fulfilling prophecies

“[a] self-fulfilling prophecy is, in the beginning, a *false* definition of the situation evoking a new behavior which make the originally false conception come *true*.” (emphasis in original)
Merton (1948)

Vise's book sold more than 180,000 copies. How much of this was due to a self-fulfilling prophecy? Hard to say.

Again, this is difficult with observational data, but possible with a multiple-realization experiment

Experimental design



More interested in song-level and system-level dynamics than individual behavior

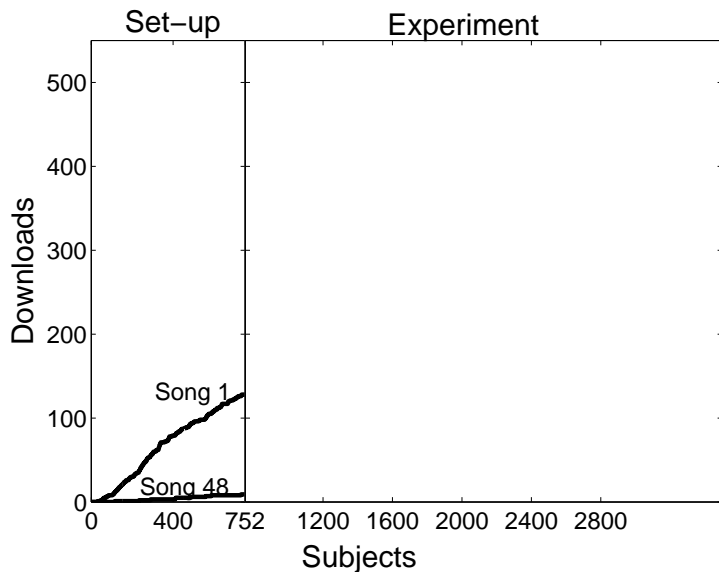
Experiment 4: Summary statistics

Experiment was active from April 7, 2005 until August 11, 2005

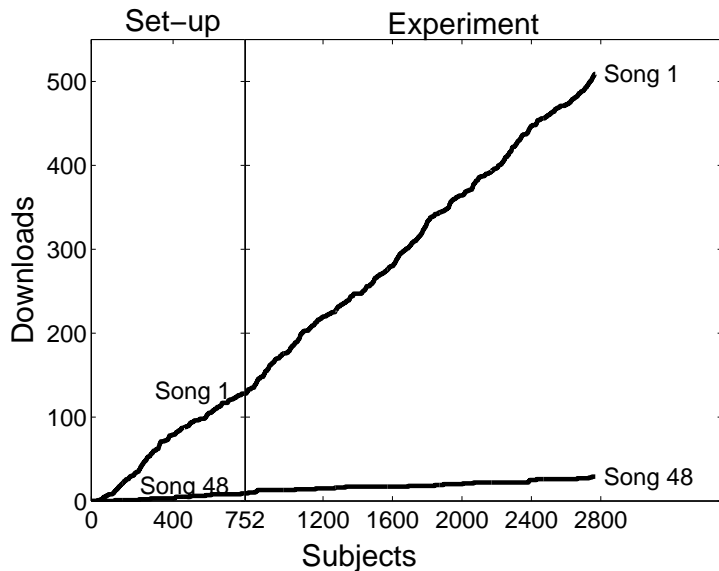
- ▶ 9,996 participants
- ▶ 69,703 listens
- ▶ 12,344 downloads

Participants drawn mostly from electronic small-world experiment.

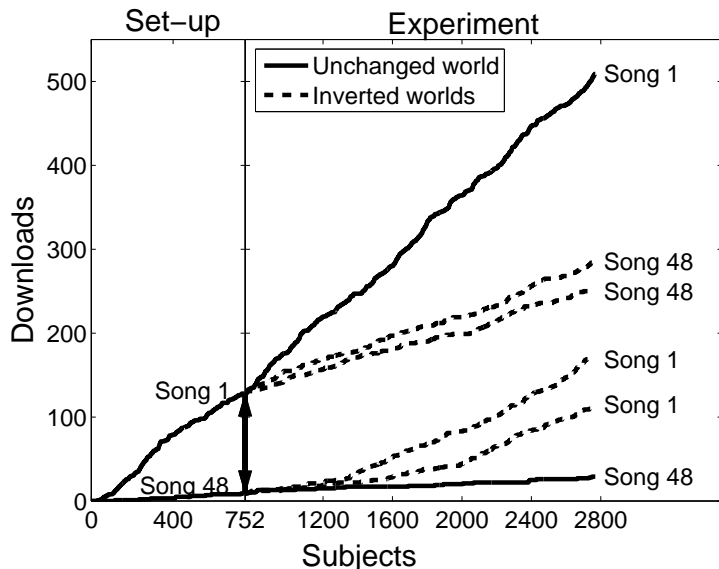
Tracking song 1 and song 48



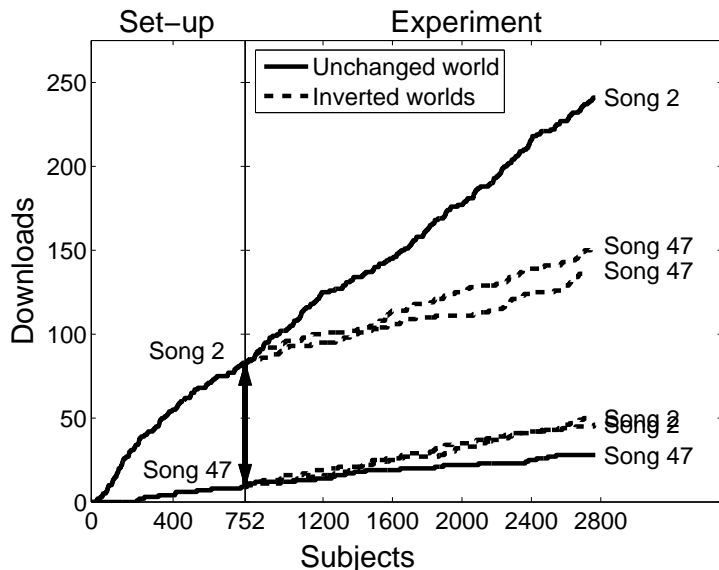
Tracking song 1 and song 48



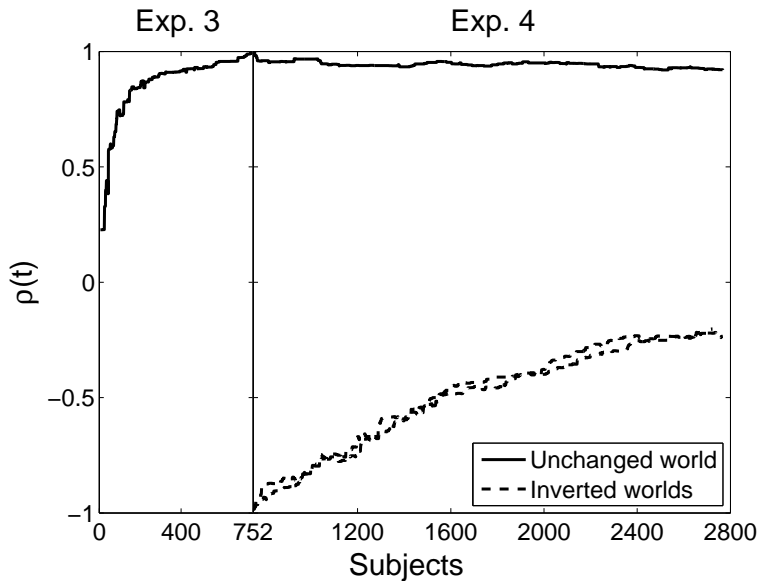
Tracking song 1 and song 48



Tracking song 2 and song 47

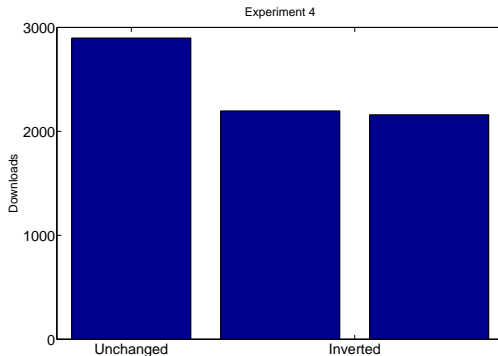


Tracking all songs: Rank correlation over time



Unintended consequence

Distortion of social information also lead to fewer downloads in the inverted worlds.



Could this really happen? Mona Lisa



Up until 1900 Mona Lisa was not a particularly famous painting, relative to the other paintings in the Louvre. In 1911 it was stolen, and later returned, and this created a huge increase in the fame of the painting.

Could this really happen? Mona Lisa

Once it became more well know, it became a object of parody and reference only reinforcing its fame

Could this really happen? Mona Lisa

Once it became more well known, it became an object of parody and reference only reinforcing its fame



(Duchamp, 1919)

Could this really happen? Mona Lisa

Once it became more well known, it became an object of parody and reference only reinforcing its fame



(Duchamp, 1919)



(Warhol, 1963)

Could this really happen? Mona Lisa

Once it became more well know, it became a object of parody and reference only reinforcing its fame



(Duchamp, 1919)



(Warhol, 1963)



(Roher, 1999)

Could this really happen? Mona Lisa

Once it became more well know, it became a object of parody and reference only reinforcing its fame



Conclusions about cultural objects

Returning to the original puzzle:

- ▶ We have shown that inequality and unpredictability of the success of songs can both arise from social influence at level of individual

Other conclusions related to cultural markets:

- ▶ Appeal mattered, but did not completely determine success
- ▶ Better songs did better **on average**, but in any particular realization the best song did not always win
- ▶ Higher appeal objects were more unpredictable

Limitations

Limitations:

- ▶ Experiment is different from the real-world
- ▶ Robustness to experimental results to design choices
- ▶ Lumps many different things together (TV, movies, books, art, music)

General conclusion

More general points:

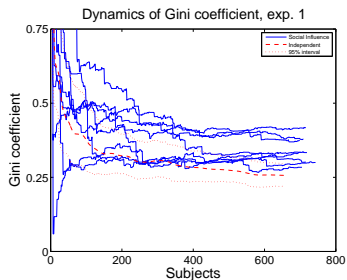
- ▶ Shows usefulness of repeated realizations framework
- ▶ Individual-level social processes can have surprising effects at the collective-level
- ▶ Experimental design is useful for studying micro-macro problems
- ▶ Internet allows for large-group macro-sociological experiments

General conclusion

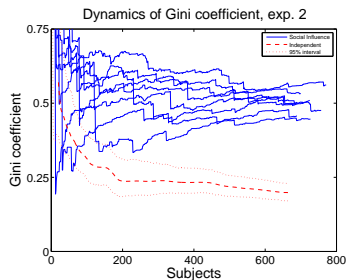
For more information:

- ▶ Salganik, Matthew J., Peter S. Dodds, and Duncan J. Watts. 2006. “Experimental study of inequality and unpredictability in an artificial cultural market.” *Science* 311:854-856.
- ▶ Salganik, Matthew J., and Duncan J. Watts. “Leading the herd astray: An experimental study of self-fulfilling prophecies in an artificial cultural market.” Under review.
- ▶ Salganik, Matthew J., and Duncan J. Watts. “Success and failure in cultural markets: A series of four experiments.” Under review.
- ▶ Salganik, Matthew J., and Duncan J. Watts. “An experimental approach to the study of collective behavior.” In preparation.

Dynamics – Gini coefficient

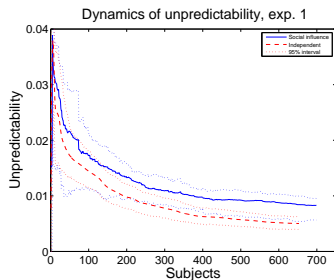


(c) Gini coefficient, experiment 1

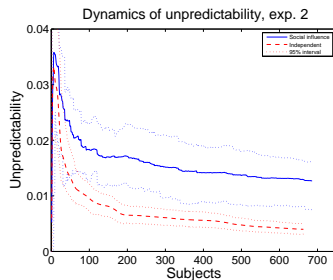


(d) Gini coefficient, experiment 2

Dynamics – Unpredictability

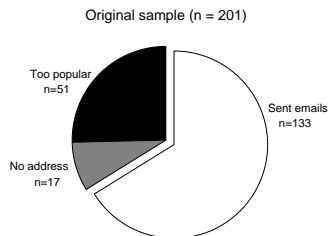


(e) Unpredictability, experiment 1

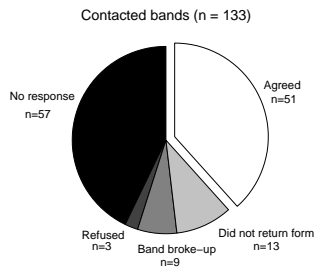


(f) Unpredictability, experiment 2

Finding the bands



(g) Original sample (n = 201)



(h) Contacted bands (n = 133)

Participant demographics

Category	www.bolt.com		Small-world experiment	
	Experiment 1 (<i>n</i> = 7, 149) (% of participants)	Experiment 2 (<i>n</i> = 7, 192) (% of participants)	Experiment 3 (<i>n</i> = 2, 930) (% of participants)	Experiment 4 (<i>n</i> = 2, 930) (% of participants)
Female	36.4	73.9	38.0	38.0
Broadband connection	74.1	69.0	90.6	90.6
Has downloaded music from other sites	60.4	62.4	69.3	69.3
Country of Residence				
UNITED STATES	79.8	81.8	68.4	68.4
BRAZIL	0.3	0.0	1.2	1.2
CANADA	4.5	4.4	6.3	6.3
UNITED KINGDOM	4.4	4.7	6.6	6.6
OTHER	11.0	9.1	18.7	18.7
Age				
14 AND YOUNGER	11.5	16.0	1.5	1.5
15 TO 17	27.8	34.9	5.7	5.7
18 TO 24	38.5	39.2	29.8	29.8
25 AND OLDER	22.3	9.9	63.1	63.1