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Theory-driven research

Causality

Online experiments

Success breed success MusicLab Generosity Cooperation Health buddle

Voting mobilizatio

Challenges

Possibilities

Tutorial

Theory-Driven Social Research with Online Experiments

WSTNet Web Science Summer School July 7, 2017

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About me

Online Experiments

Milena Tsvetkova

Theory-driven research

Causality

Online experiments Success breeds success MusicLab Generosity Cooperation

Voting mobilization

Challenges

Possibilities

Tutorial

Dr. Milena Tsvetkova

Assistant Professor, Department of Methodology London School of Economics and Political Science m.tsvetkova@lse.ac.uk http://tsvetkova.me/

- Sociology
- Computational Social Science
 - Network analysis
 - Agent-based modelling
 - Online experiments

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Theory-driven research

Causality

- Online experiments
- Success breeds success MusicLab Generosity Cooperation Health buddies
- mobilization
- Challenges
- Possibilities
- Tutorial

Web data



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Theory-driven research

Causality

Online

experiments

Success breeds success MusicLab Generosity Cooperation

Health budd

mobilizatio

Challenges

Possibilities

Tutorial

Data-driven research

WIRED MAGAZINE: 16.07

SCIENCE : DISCOVERIES 🔂

The End of Theory: The Data Deluge Makes the Scientific Method Obsolete

By Chris Anderson 🖂 06.23.08



THE PETABYTE AGE:

Sensors everywhere. Infinite storage. Clouds of processors. Our ability to capture, warehouse, and understand massive amounts of data is changing science, medicine, business, and technology. As our collection of facts and figures grows, so will the opportunity to find answers to "All models are wrong, but some are useful."

So proclaimed statistician George Box 30 years ago, and he was right. But what choice did we have? Only models, from cosmological equations to theories of human behavior, seemed to be able to consistently, if imperfectly,

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Theory-driven research

Causality

Online .

Success breeds success MusicLab Generosity Cooperation Health buddies Voting mobilization

Challenges

Possibilities

Tutorial

Data-driven research

"Out with every theory of human behavior, from linguistics to sociology. [...] Who knows why people do what they do? The point is they do it, and we can track and measure it with unprecedented fidelity. With enough data, the numbers speak for themselves."

"Petabytes allow us to say: "Correlation is enough." We can stop looking for models. We can analyze the data without hypotheses about what it might show. We can throw the numbers into the biggest computing clusters the world has ever seen and let statistical algorithms find patterns where science cannot."

"Correlation supersedes causation, and science can advance even without coherent models, unified theories, or really any mechanistic explanation at all. There's no reason to cling to our old ways."

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Theory-driven research

Causality

Online experiments Success breed

success MusicLab Generosity Cooperation Health buddi

Voting mobilization

Challenges

Possibilities

Tutorial

Theory- vs./ data-driven research

Theory-driven research (Deductive reasoning)

testable hypothesis

general theory

empirical test

confirmation/rejection

Data-driven research (Inductive reasoning)

empirical observation detectable pattern tentative hypothesis general theory

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Theory-driven research

Causality

Online experiments

Success breed success MusicLab Generosity Cooperation Health buddie

Voting mobilization

Challenges

Possibilities

Tutorial

Theory- vs./ data-driven research

Theory-driven research (Deductive reasoning)

general theory

empirical test

confirmation/rejection

Data-driven research (Inductive reasoning)

empirical observation

tentative hypothesis

general theory

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Theory-driven research

Causality

Online experiments

Success breed success MusicLab Generosity Cooperation Health buddie Voting

Challenges

Possibilities

Tutorial

Theory-focused research

Theory-driven research (Deductive reasoning)

general theory

empirical test

confirmation/rejection

Data-driven research (Inductive reasoning)

empirical observation detectable pattern tentative hypothesis general theory

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Theory-driven research

Causality

Online experiments Success breeds success MusicLab Generosity Cooperation Health buddies Voting mobilization

Challenges

Possibilities

Tutorial

Theory-driven research



- Correlation
- Counterfactual approach
- Experiments
 - Natural experiments
 - Randomized controlled experiments
 - Field experiments
 - Lab experiments

Online Experiments Milena

Randomized controlled experiments

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Causality

- Online experiments Success breeds success MusicLab Generosity Cooperation Health buddies Voting mobilization
- Challenges
- Possibilities
- Tutorial

- Recruitment
- Random assignment
- Intervention: treatment + control
- Outcome measurement

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Causality

Online experiments

Success breeds success MusicLab Generosity Cooperation Health buddies Voting mobilization

Challenges

Possibilities

Tutorial

Online experiments

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- Simple recruitment
- Diverse samples
- Low/no costs per participant
- Fast completion times
- Easy to scale up

Not just a quantitative change – can now run entirely new experimental designs

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Success breeds potentially low low high Use existing systems complex Just do it relatively medium medium Build an experiment hiah vourself easy relatively Build a product high high high easv Making it happen A Partner potentially Partner with the powerful with the medium hiah low complex powerful

> Salganik, M. (2017). *Bit By Bit: Social Research in the Digital Age*. Retrieved from: http://www.bitbybitbook.com.

Running online experiments

Cost Control Realism Ethics

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Challenges

Possibilities

Tutorial

Success breeds success

• Social feedback in human reward systems produces inequality





WIKIPEDIA The Free Encyclopedia

change.org

- Funding to 200 Kickstarter projects
- Positive ratings to 305 Epinions reviews
- Barnstars to 521 Wikipedia editors
- Signatures to 200 Change.org petitions

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Causality

Online experiments

Success breeds success

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Challenges

Possibilities

Tutorial

Success breeds success

• Success breeds success but with decreasing marginal returns



Fig.2. The success-breeds-success effect over time. The curves represent running numbers of donations (blue), positive ratings (red), awards (yellow), and campaign signatures (green) in the experimental conditives (red) lenge and the control condition (dashed lines). The horizontal axis is normalized so that 0 marks the time of experimental intervention, and 1 marks the end of the observation period. The vertical axis is normalized so that for each system avalue of 1 equals the maximum across time and conditions.

van de Rijt, A., Kang, S.M., Restivo, M., & Patil, A. (2014). Field experiments of success-breeds-success dynamics. Proceedings of the National Academy of Sciences, 111(19), 6934–6939.

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Causality

- Online experiments
- Success breeds success

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Generosity Cooperation Health buddies Voting mobilization

Challenges

Possibilities

Tutorial

- Social influence generates inequality and unpredictability in cultural markets
- Artificial music market, multiple "universes", 14,341 participants

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Figure S1: Schematic of the experimental design.

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Causality

Online experiments

Success breeds success

MusicLab

Generosity Cooperation Health buddi

Voting mobilizatio

Challenges

Possibilities

Tutorial

• Social influence increases inequality, unpredictability of success

MusicI ab

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	e of tiown kada	[Help] [Log.off]	e d down laada		# # 5047 1045
HARTSPIELD. "enough is enough"	30	GO MOREDCA: "It does what its told"	12	UNDO: "while the world passes"	24
DEEP ENOUGH TO DIE: "for the sky"	17	PARKER THEORY: "the sold"	47	UP FOR NOTHING: "In sight of	13
THE THRFT SYNDRCATE: "2002 a stagedy"	20	MSS OCTOBER "pink agencien"	IJ	SILVERIOX.	17
THE BROKEN PROMISE: "the end in friend"	29	POST BREAK TRAGEDY: "Resece"	14	STRANGER 'one dep'	30
THIS NEW DAWN: "The belef above the zeroses"	12	PORTHFADING "Mail	24	PAR PROMISIONS: "Kudo 9"	38
NOONER AT MINE: "nob. prezy"	6	THE CALEFACTION: "httpped is an entropy peel"	20	STURT NORKEY: Testile out	45
MDRAL HAZARD "wates of my Ho"	8	S2METRO "Ecidove"	17	DANTE: "Hes mystery"	н
NOT FOR SCHOLARS: "as reasons change"	27	SIMPLY WAITING: "went with the coant"	16	FADING THROUGH: Swith the lack"	30
SECRETARY "keep your eyes as the ballates"	5	STAR CLIMBER. "WEINE"	38	UNKNOWN OTIZENS "billing over"	н
ARTOF KASLY: "seductive intro, methodic breakdown"	30	THE FASTLANE: "If death do us part 8 doet?"	31	BY NOVEMBER "If result take you"	20
HYDRALLIC SANDINCH "repairtion anisty"	20	A BUIMONG SILENCE: "miseries and mitocles"	17	DRAWN IN THE SAY	12
EMDER SKY: "This opcoming winter"	25	SUN RANA "the bolkhevik boogie"	15	SELSIUS: "Stars of the city"	22
SALUTE THE DAWN	11	CAPE REMEWAL: "baseball warbok v1"	12	SLEPEAN "eye parch"	ж
ITYAN ESSMAKER: 'delost, the still'	34	UP FALLS DOWN "a log kter burning star"	11	EVAN GOLD	30
REERBONG: "table to see"	12	SLIMMERSWASTED: "a plan behind destruction"	17	REMERIT OF A DOUET: "NO DROY"	24
HALL OF FAME:	19	SLENTFLM	61	SHEWIECK UNDE	35

Figure S2: Screenshot of the song menu in the social influence world in experiments 1. Screenshot from the independent condition (not shown) was identical except that the download counts to the right of each song are removed.

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Causality

Online experiments

Success breeds success

MusicLab

Generosity Cooperation Health buddies Voting

- Challenges
- Possibilities

Tutorial

• Social influence increases inequality, unpredictability of success

MusicI ab

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	[Help] [Log.off]	# of down loads		
	PARKER THEORY: "she cald"	359		
	THE FASTLANE: "If death do us part 6 dont?"	102		
	SELSUS "stars of the city"	62		
	STURT MORKEY: "mile call	56		
	RY MOVEMBER: "# icceld take yes"	55		
	FORTHFADING: 'New'	49		
	HYDRAULIC SANDWICK: "hepatolice anxiety"	43		
	SILENT FILM: "all there to say"	40		
	LNDC: "while the world passes"	36		
	RENEPIT OF A DOUBT: "An away"	32		
	A BLINDING SILENCE "Interfease and interclas"	27		
	MISS OCTOBER: "pilk agressio"	20		
	STAR CLIMBER: "tel me"	24		
	FAR FROM KNOWN "Reak 9"	22		
	HALL OF FAME: "best motivies"	21		
	EMBER SKY	29		

Figure S3: Screenshot of the song menu in the social influence world in experiments 2. Screenshot from the independent condition (not shown) was identical except that the download counts to the right of each song are removed.

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Online experiments

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Challenges

Possibilities

Tutorial

• Social influence increases inequality, unpredictability of success

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Figure S4: Screenshot of the listening screen. While a song was playing subjects where required to rate it on a scale of 1 to 5 stars. This rating could be submitted before the song was finished playing.

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Causality

Online experiments

Success breeds success

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Generosity Cooperation Health buddie Voting

Challenges

Possibilities

Tutorial

• Social influence increases inequality, unpredictability of success

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Figure S5: Screenshot of the download decision screen. After rating the song, subjects had to decide to download the song or not.

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Theory-driver research

Causality

Online experiments

Success breeds success MusicLab

Generosity

Cooperation Health buddies Voting mobilization

Challenges

Possibilities

Tutorial

- Pro-social behavior can spread through generalized reciprocity and third-party influence
- 518 AMT workers with up to 6 interactions in groups of 150

From: Cornell SDL <<u>mvt9@cornell.edu</u>> Subject: You have been invited to the Invitation Game

Message from Cornell SDL (mvt9@cornell.edu)

Dear turker,

You have been invited to complete the task associated with the MTurk HIT "Sign up to participate in the Invitation Game," which you submitted. Your invitation is valid for the next 24 hours.

To complete the task, please use the following information:

* MTurk Worker ID: A27L6Z6PBCE04Y
* Invitation ID: ILUS

and:

 Go to <u>https://sdlab.soc.cornell.edu/study11/igame/</u> and complete the task.
After you have completed the task, go to <u>https://www.mturk.com/mturk/preview?groupId=2FH56XBAT2D5PP8RRYU07JG7YZP041</u> and submit the HTT.

Thank you for your participation!

Best regards,

Milena Tsvetkova, Cornell SDL

Tsvetkova, M., & Macy, M.W. (2014). The social contagion of generosity, PLoS ONE, 9(2) ≡ e87275 _ , Q (

Generosity

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Theory-driver research

Causality

Online experiments

Success breeds success

Generosity

Cooperation Health buddies Voting mobilization

Challenges

Possibilities

Tutorial

• Pro-social behavior can spread through generalized reciprocity and third-party influence

Generosity

• 518 AMT workers with up to 6 interactions in groups of 150



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Theory-driver research

Causality

Online experiments

Success breeds success

Generosity

Cooperation Health buddies Voting mobilization

Challenges

Possibilities

Tutorial

• Pro-social behavior can spread through generalized reciprocity and third-party influence

• 518 AMT workers with up to 6 interactions in groups of 150



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Generosity

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Theory-driver research

Causality

Online experiments

Success breeds success MusicLab

Generosity

Cooperation Health buddies Voting mobilization

Challenges

Possibilities

Tutorial

• Pro-social behavior can spread through generalized reciprocity and third-party influence

Generosity

• 518 AMT workers with up to 6 interactions in groups of 150



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Theory-driver research

Causality

Online experiments

Success breeds success

Generosity

Cooperation Health buddies Voting mobilization

Challenges

Possibilities

Tutorial

• Pro-social behavior can spread through generalized reciprocity and third-party influence

Generosity

• 518 AMT workers with up to 6 interactions in groups of 150



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- Theory-driven research
- Causality
- Online
- Success breeds success
- Generosity
- Cooperation Health buddies Voting mobilization
- Challenges
- Possibilities
- Tutorial

• Receiving generosity increases generosity but observing it may have the opposite effect

Generosity





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Theory-driver research

Causality



Challenges

Possibilities

Tutorial

• Strategic partner selection helps the emergence of cooperation

+ 1,529 AMT workers in 90 networks of ≈ 17



Cooperation

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Theory-driver research

Causality

Online experiments

Success breed success MusicLab

Generosity Cooperation

Health buddies

Challenges

Possibilities

Tutorial

• Strategic partner selection helps the emergence of cooperation

• 1,529 AMT workers in 90 networks of ≈ 17



Cooperation

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Theory-driver research

Causality

Annual Success breeds success MusicLab Generosity Cooperation Health buddies Voting mobilization

Challenges

Possibilities

Tutorial

• Strategic partner selection helps the emergence of cooperation

• 1,529 AMT workers in 90 networks of ≈ 17



Shirado, H., Fu, F., Fowler, J. H., & Christakis, N. A. (2013). Quality versus quantity of social ties in experimental cooperative networks. *Nature Communications*, 4, 2814, Sector 2014, Sector 2014,

Cooperation

Cooperation

Online Experiments

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- Theory-driven research
- Causality
- Online experiments
- Success breeds success MusicLab Generosity
- Cooperation
- Health buddi Voting mobilization
- Challenges
- Possibilities
- Tutorial





Shirado, H., Fu, F., Fowler, J. H., & Christakis, N. A. (2013). Quality versus quantity of social ties in experimental cooperative networks. *Nature Communications*, 4, 281<u>4</u>, by the set of the set

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Theory-driven research

Causality

- Online experiments
- Success breeds success MusicLab
- Generosity
- Cooperation
- Health buddies
- Voting mobilization
- Challenges
- Possibilities
- Tutorial

Health buddies

- Costly behavior spreads differently than disease and rumors
- 6 runs of 2 seeded networks; 1528 participants; outcome is registration for a health forum



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Theory-driven research

Causality

- Online experiment
- Success breed success
- Generosit
- Cooperation
- Health buddies

Voting mobilization

Challenges

Possibilities

Tutorial

Health buddies

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- Costly behavior spreads differently than disease and rumors
- 6 runs of 2 seeded networks; 1528 participants; outcome is registration for a health forum



Centola, D. (2010). The spread of behavior in an online social network experiment. *Science*, 329(5996), 1194–1197.

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Causality

- Online experiments
- Success breed
- Generosity
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- Health buddies
- Voting mobilization
- Challenges
- Possibilities
- Tutorial

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Causality

- Online experiment Success brea success MusicLab Generosity Cooperation
- Health buddies
- Voting mobilization
- Challenges
- Possibilities
- Tutorial

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Mayo Clinic Fitne Reas (rating of Information on even obstacles, and inju-	How did you hear about the Forum?	y: Kick the Habit ut of 25 votes) imation and specific guidelines ling motivation for cessation, a fine heat was the well.
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from the	1 C 2 C 3 C 4 C 5 C	t of 24 votes) out weight loss, diet, and

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Causality

- Online
- Success breeds
- Generosity
- Cooperation
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Voting mobilization

- Challenges
- Possibilities
- Tutorial

• The behavior spreads farther and faster across clustered networks than random networks

Health buddies



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Voting mobilization

Challenges

Possibilities

Tutorial

Voting mobilization

Jaime Settle, Jason Jones, and 18 other friends have voted.

- Costly behavior such as voting spreads through social influence
- 61 million Facebook users, 6.3 million matched to voter records



Bond, R.M., Fariss, C.J., Jones, J.J., Kramer, A.D.I., Marlow, C., Settle, J.E., & Fowler, J.H. (2012). A 61-million-person experiment in social influence and political mobilization. *Nature*, 489(7415), 295–298.

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Causality

- Online experiments
- Success bree success MusicLab
- Generosity
- Cooperation
- Health budd

Voting mobilization

- Challenges
- Possibilities
- Tutorial

Voting mobilization

- Social messages make people more likely to claim they voted
- Information messages have no effect on voting
- Social messages make users 0.39% (p = 0.02) more likely to vote compared to no messages



Bond, R.M., Fariss, C.J., Jones, J.J., Kramer, A.D.I., Marlow, C., Settle, J.E., & Fowler, J.H. (2012). A 61-million-person experiment in social influence and political mobilization. *Nature*, 489(7415), 295–298.

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- Online experiments
- Success breeds success MusicLab Generosity Cooperation Health buddies Voting mobilization

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- Possibilities
- Tutorial

- Recruitment and retention
- Strong stimuli and engagement
- Repeated social interaction
- Retention and engagement similar across treatments
- Retention and engagement uncorrelated to outcome
- Undesirable repeated participation

Thinking ahead

• Gaming

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Challenges

Possibilities

Tutorial

1.8 billion gamers online worldwide 711 million active gamers 48% of active gamers play social games 35 years old on average 41% female gamers

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Challenges

Possibilities

Tutorial

• Gamification: use of game design elements in non-game contexts

Thinking ahead



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Online experiment

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Challenges

Possibilities

Tutorial

• Gamification in science

Image tagging





Thinking ahead

Neuron mapping



Quantum computing



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500

3

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- Causality
- Online experiments
- Success breeds success MusicLab Generosity Cooperation Health buddies Voting
- Challenges

Possibilities

Tutorial

Thinking ahead

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- Gamification in social science
 - Use of non-financial incentives to conduct social experiments online
 - e.g. Axelrod's PD tournament
 - Good game design is essential!

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Online experiments

Success breed success MusicLab Generosity Cooperation Health buddie Voting

Challenges

Possibilities

Tutorial

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Salganik, M. (2017). *Bit By Bit: Social Research in the Digital Age*. Retrieved from: http://www.bitbybitbook.com.

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- Online experiments
- Success breeds success MusicLab Generosity Cooperation Health buddies Voting
- Challenges
- Possibilities
- Tutorial

• Crowdsourcing platforms, online marketplaces

- Amazon Mechanical Turk
- CrowdFlower
- • craigslist
- Citizen science projects
- Online advertisement
- Social media
- Traditional methods

Recruiting participants

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- Online experiments
- Success breeds success MusicLab Generosity Cooperation Health buddies Voting
- Challenges
- Possibilities
- Tutorial

Building an experiment

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- Single, sequential, or periodic interactions
 - HTTP + server-side scripting (Python, PHP, etc.)
- Multi-player, real-time interactions
 - e.g. Node.js + Socket.io + HTML5
- Intervention and observation
 - APIs, web-scraping

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Causality

- Online experiments
- Success breeds success MusicLab Generosity Cooperation Health buddies Voting mobilization
- Challenges
- Possibilities
- Tutorial

Using existing experimental platforms

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- ► Volunteer Science
- Lab in the Wild
- ► Test My Brain
- Network game experiments
 - TurkServer
 - breadboard
 - nodeGame

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- Online experiments
- Success breeds success MusicLab Generosity Cooperation Health buddies Voting
- Challenges
- Possibilities
- Tutorial

Task: Participate in an experiment

- Complete an experiment/study from one of these sites:
 - http://www.mturk.com (if you have worker account)

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- http://volunteerscience.com/
- http://www.labinthewild.org/
- http://testmybrain.org/

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- Online experiments
- Success breeds success MusicLab Generosity Cooperation Health buddies Voting
- Challenges
- Possibilities

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Task: Design an experiment

- Design an experiment to answer a specific research question:
 - Does the proliferation of choice options produce more unequal cultural markets?
 - Are bronze-medal winners happier than silver-medal winners?
 - Does higher uncertainty in product quality produce more unequal consumer markets?
 - Are women discriminated against on social media?
 - Do good news spread faster than bad news?
- Discuss modified question, participant recruitment, technical implementation, treatments, dependent variable, ethical considerations