

# Computational Social Systems

## Week 2

**Fariba Karimi**

Prof. Dr.

Computer Science Department, TU Graz

e-mail: karimi@tugraz.at

web: [www.networkinequality.com](http://www.networkinequality.com)

TU Graz, 15.10.2024

---

# Recap of week 1

- Brief history of quantitative (social) sciences
- Different types of data collection in the past and present times
- Questions:
  - What is a complex system?
  - What is its property?
  - Is society a complex system?

---

Part 1

# **SOCIAL IMPACT**

# Social Impact Theory

**Definition:** changes in behaviour that occur in an individual as a result of the presence or actions of other individuals.

**Examples of behavior:**

subjective feelings, motives, emotions, thoughts, customs, decisions...

**The presence or actions of others can be:**

- *real*: the physical presence of others
- *implied*: expected or manipulated presence, e.g. a cardboard policeman
- *imagined*: mental representation of others,  
e.g. supporters of your team when watching TV sports

# Asch's conformity experiments

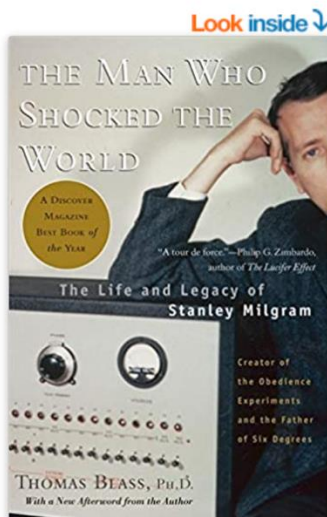


# Stanley Milgram

- A social psychologist
- Yale and Harvard University
- For which studies is he famous?



1933-1984



## The Man Who Shocked The World: The Life and Legacy of Stanley Milgram Paperback – 24 Feb. 2009

by [Thomas Blass](#) (Author)

★★★★★ 35 ratings

[See all formats and editions](#)

Kindle Edition  
£8.99

[Read with Our Free App](#)

Hardcover  
£24.99

7 Used from £6.77  
1 New from £24.99

Paperback  
**£12.99**

6 Used from £12.98  
5 New from £12.99

Creator of the famous Obedience Experiments and originator of the 'six degrees of separation' theory, Stanley transformed our understanding of human nature and continues to be one of the most important figures in psychology and beyond. In this sparkling biography, Thomas Blass captures the colorful personality and pioneering work of a visionary scientist who revealed the hidden workings of our social world. In this new paperback edition, he includes an afterword connecting Milgram's the torture, war crimes, and Abu Ghraib.

# Milgram imitation experiments

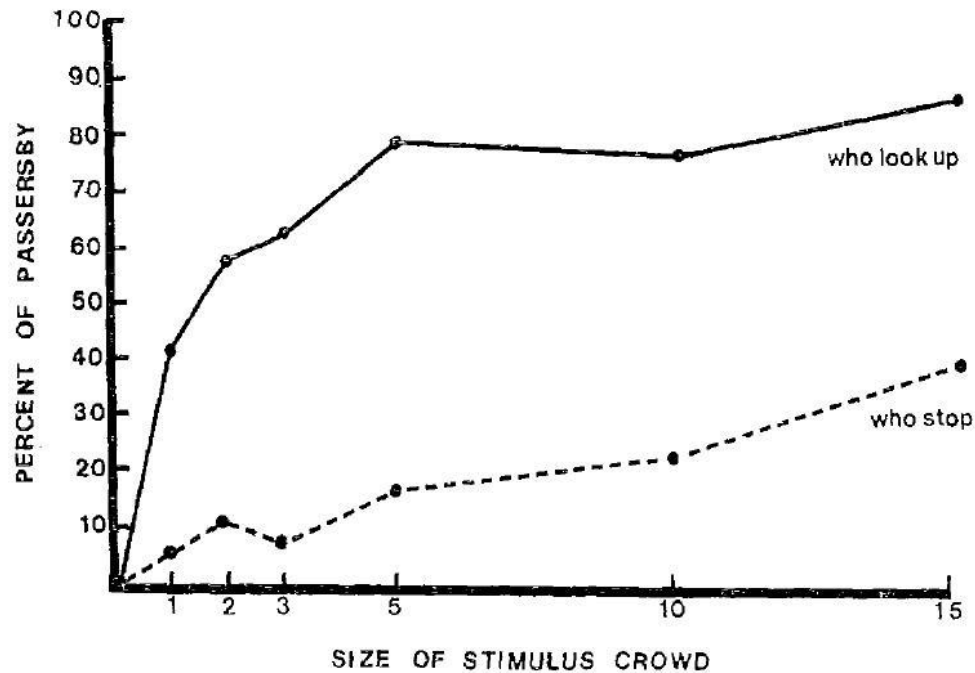


FIG. 1. Mean percentage of passersby who look up and who stop, as a function of the size of the stimulus crowd.



# What are the factors (in sources) that impact the target person?

and magnetism) operating in a social force field or social structure. As an example of what I mean by a social force field, Figure 1 depicts the plight of a hapless striped target beset by a variety of spotted sources, all having some impact.

*Principle 1: Social Forces,  $I = f(SIN)$*

As a first principle, I suggest that when some number of social sources are acting on a target individual, the amount of impact experienced by the target should be a multiplicative function of the



# Social Impact Theory (Bibb Latane)

In Social Impact Theory (SIT), social impact is driven by three forces:

$$I = f(S \times i \times N)$$

- $I$  is the magnitude of social impact
- $f()$  is a multiplicative function of three conditions of the impact:
  1. Strength  $S$  or power of the source(s)
  2. Immediacy  $I$  or proximity of the source(s)
  3. Number of sources  $N$  or number of people

# N: Number of sources

SIT predicts that impact should grow with N. Asch's conformity experiments test this hypothesis where:

- I: increase in the percentage of wrong answers given by students that were experiment subjects
- N: controlled number of confederates

The result: the percentage of wrong answers grows with the amount of sources.

effects have long been understood as allelomimetic conformity, common, normative influence, social facilitation, and social inhibition. In general, the research suggests that each of these effects is understood as reinforced by social forces in a group, as in the strength, number of people who are the source, and increases in their number. In this section, I discuss

there is a perceptual bias among group members.

Although the most common finding is that conformity increases in group size, the most troubling aspect of the research is that people faced with a choice between conforming and being a conformer conform. The first person to conform is expected to have a strong influence on such counterfactuals. Students may be sufficient to have a substantial amount of influence on the group.

# The Psychosocial Law

## The Psychosocial Law:

The extent of social impact grows ??? with the number of sources.

effects have long been understood as allelomimetic conformity, common, normative influence, social facilitation, and social inhibition. In general, the effects of social forces in a group are understood as reciprocal. As the number of sources increases in their strength, the impact on the individual decreases. In this section, I discuss

there is a perception of consensus among group members.

Although the most striking feature of Asch's data is that conformity does not seem to increase with increases in group size beyond three members, the most troubling aspect for social impact theory is that people faced with but one or two incorrect conformers conformed so little—in the present theory, the first person added to a social setting is expected to have the most impact. However, for such counterfactual judgments, Swarthmore students may be sufficiently independent as to require a substantial amount of social pressure just to bring

# The Psychosocial Law

## The Psychosocial Law:

The extent of social impact grows sublinearly with the number of sources.

This can be translated to the equation:

$$I \propto N^t, t < 1$$

This means that the hundredth source has less additional effect than the first (*diminishing returns*).

The equation is what is called a power-law with exponent  $t$ . In the case of conformity among high school students,  $t$  was estimated to be 0.48.

effects have long been understood as allelomimetic conformity, common, normative influence, social facilitation, and social inhibition. In general, research suggests that each of these effects is understood as reciprocal social forces in a group. As the strength of the influence of people who are the source of the influence increases in their number, the effect of the group on the individual decreases. In this section, I discuss the psychosocial law.

there is a perception of social pressure from group members.

Although the most common explanation is that conformity decreases as group size increases, the most troubling aspect of the social influence is that people faced with the decision to conform or not to conform conform. In the case of conformity, the first person to conform is expected to have the most influence. Such counterfactual judgments may be sufficient to cause a substantial amount of conformity.

# S: Strength of sources

The strength in SIT is the perceived social status, power, wealth, importance, or intensity of the sources. Poem experiment example:

- I: anxiety of the students recorded with a dial they use to measure their own anxiety
- N: number of people in the audience
- S: audience is middle-aged (strong) or teenagers (weak)

**Multiplicative effect:** The impact of the number of sources grows faster when they are strong than when they are weak

multiplicative relationship for the brightness match, the comparable relationship for loudness is very similar.

It is probably no surprise to psychologists familiar with cross-modality matching that people can do a good job on these tasks, but we were impressed by the remarkable ease and confidence with which our participants made these unusual comparisons. Not only were they able to equate such disparate commodities as nervousness, loudness, and brightness, but they did so in an impressively lawful manner. These results are based on subjective estimates about reactions to imagined situations, making them potentially responsive to such sources of bias as experimenter demand. Although cross-modality matching does not preclude expectations as to the existence or direction of effects, the complexity of the procedure would seem to make it unlikely that participants were merely responding to demand characteristics with respect to the shape of the functions. That we found

Social tension as a function of audience size.

# i: immediacy of sources

Immediacy is defined as the proximity between the sources and the target of social impact. Immediacy can be spatial, temporal, or social. The effect of immediacy in media bias experiments:

- I: number of lines used to report the news by the students
- N: number of people reported dead in the accident
- i: is the distance to the place of the accident (close vs far conditions)

Results: The growth of impact with N was steeper for the close condition

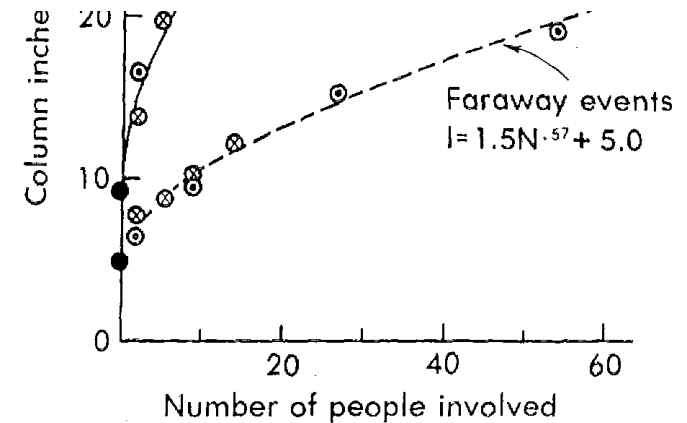


Figure 4. Interest value of news events as a function of number of people involved, based on data from Bassett and Latané (Note 1). Different circles reflect responses from different people exposed to different ranges of numbers of people involved.

leaders as having higher status and the test was sufficiently powerful to detect moderate effects, it is not clear whether this failure to find a difference represents a general exception to the theory or simply the operation of some factor related to catastrophes. For example, the idea that death is

Interest value of news events as a function of number of people involved. (source: )

# Plane crash reports in Wikipedia

ROYAL SOCIETY  
OPEN SCIENCE

[rsos.royalsocietypublishing.org](https://rsos.royalsocietypublishing.org)

Research



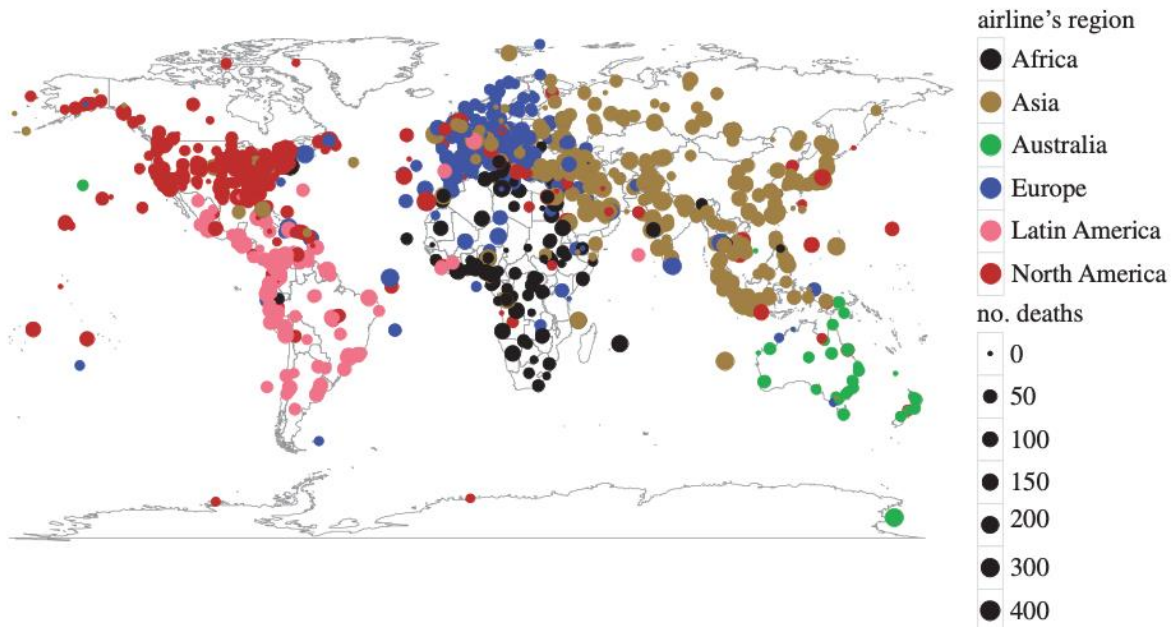
CrossMark  
click for updates

Cite this article: García-Gavilanes R,

## Dynamics and biases of online attention: the case of aircraft crashes

Ruth García-Gavilanes, Milena Tsvetkova and

Taha Yasseri



# Plane crash reports in Wikipedia

**Table 3.** Death equivalence ratios based on the viewership data from English and Spanish Wikipedias. (The matrix is calculated according to the coefficients reported on the upper part of [table 2](#). For six different airline continents, the matrix shows the ratio of triggered attention, controlling for the number of deaths. For example, the attention given to events caused by a North American Airline in English Wikipedia is on average 2 and 47 times larger than to the events caused by European and African companies, respectively. In Spanish Wikipedia, the level of attention given to events related to Latin America is three times larger than the European events, five times larger than North American and 10 times larger than Asian events.)

	English Wikipedia					
	Africa	Australia	Latin America	Asia	Europe	North America
Africa	1	2	2	6	26	47
Australia		1	1	4	16	28
Latin America			1	4	16	28
Asia				1	4	8
Europe					1	2
North America						1

García-Gavilanes, R., Tsvetkova, M., & Yasseri, T. (2016). Dynamics and biases of online attention: the case of aircraft crashes. *Royal Society open science*, 3(10), 160460.



## Division of impact

three quarters of individuals tested alone helped; only half of those tested with others did so. Further, in 31 of an additional 37 comparisons between persons tested alone and actual groups of 2–8 people, the effective individual probability of helping was less than the alone response rate, while in 4 others, the comparison was indeterminate. About half of the 2,028 individuals tested alone in these studies helped, whereas the effective individual response rate for the more than 1,600 people tested in groups was only 22%. Clearly, social inhibition occurs in both laboratory and field settings employing a wide variety of emergencies designed by a multitude of independent investigators.

According to the psychosocial law, the biggest increment in social inhibition should occur with the addition of the first other bystander, subse-

# Division of impact

Social Impact Theory also covers situations with one source but when targets are not alone. It formulates the impact  $I$  on **each** target as:

$$I = f\left(\frac{1}{S \times i \times N}\right)$$

Where the terms are:

- $S$  strength of the targets: the stronger the targets, the harder to impact each one.
- $i$  immediacy between the targets: the closer or more connected the targets, the harder to impact each one.
- $N$  the more the targets in the group, the harder to impact each one.
- $f()$  is a multiplicative function with negative exponents for the terms.

# Division of impact

The most widely studied divisor of impact is group size (N). An observational study finds the effect for the case of restaurant tips:

- I: Percentage of tip (assumed evenly shared among customers)
- N: number of customers at the table

Result: I decreases as N increases.

The more people sitting at the same table, the less obliged each one feels to leave a tip.

The resulting shape of I as a function of N is well-fitted by a negative power of N.

proportion to the square root of the number of people available to pick up obligations. The need for help shown by the waiter was seemingly divided among the members of the target of this need.

... a parenthetical plug for the University of Illinois at Urbana-Champaign's table psychological laboratory. Williams, Harkins, & Latane (1969) were catered up with surplus equipment and a steady stream of subjects who came to the lab for a variety of reasons.

## bystander effect

“38 Who Saw Murder Didn’t Call the Police”.

**bystander effect:** division of impact in case of intervening or helping.

In this case the individual change of behavior (calling the police) decreases with the number of people impacted (number of neighbors watching).

If impact per observer becomes too low, nobody might intervene, producing a paradoxical situation like the one reported by the New York Times.

The bystander effect has been widely replicated in experiments and observed in many other situations.

Closely related to the **tragedy of the commons**.

---

Part 2

# **SOCIAL IMPACT IN MODERN TIMES**

# Time series of the number of views of a video.

Question: what has sparked such a pattern in the number of views?



# Social impact

## Justine Bieber effect!

 **Justin Bieber**  @justinbieber · 11 Jul 2013  
so many activities it is making my **head spin!** haha

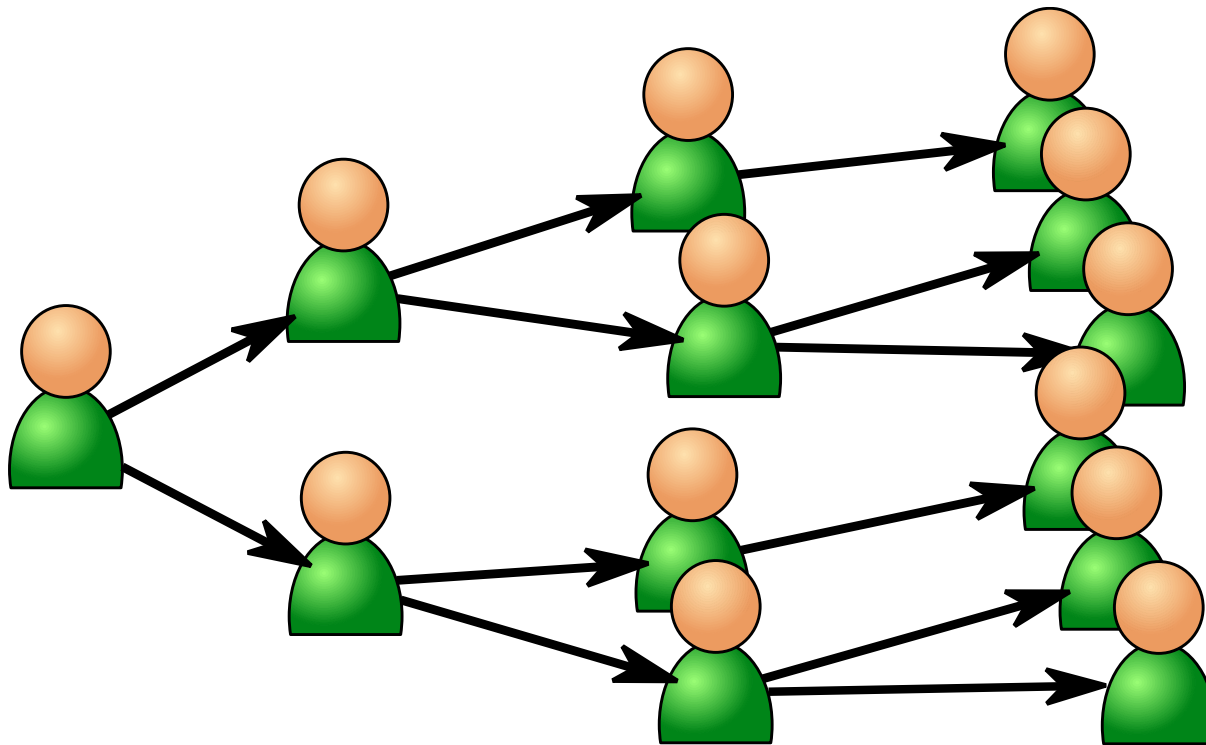
 **Step Brothers- 'Activities'**  
My favoruite clip from the movie Step Brothers. Credit in video to Columbia Pictures. Copyright Columbia Pictures [2009]  
[youtube.com](#)

**Step Brothers- 'Activities'**

 Worble  
 **Subscribe** 192

 **RETWEETS** **LIKES**  
**58,887** **47,530**  
**235,460 views**

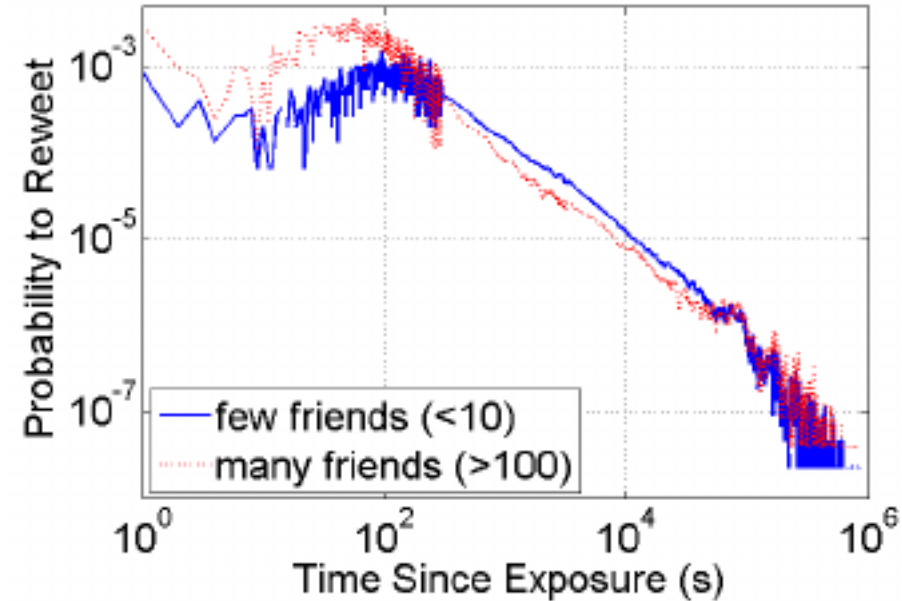
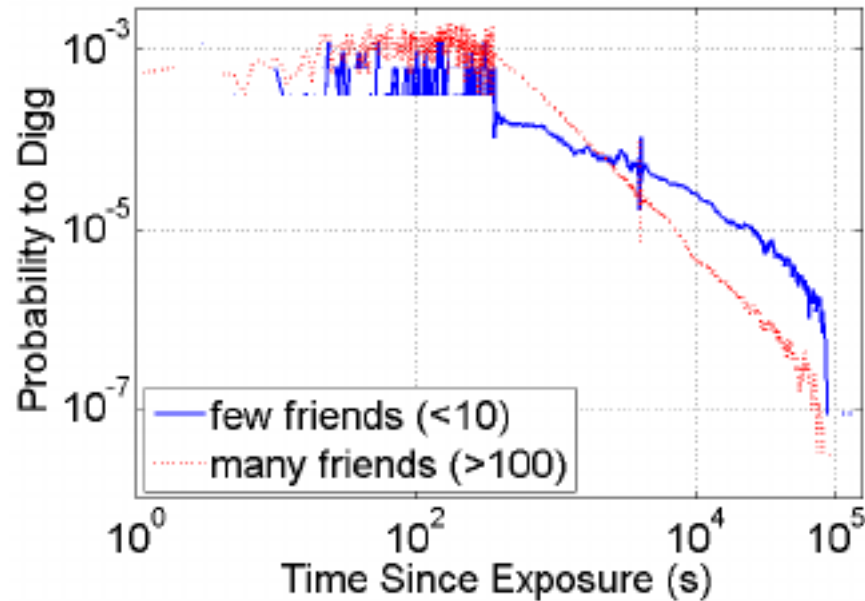
## (Supercritical spreading: viral marketing)



Kristina Lerman's review ["Information Is Not a Virus, and Other Consequences of Human Cognitive Limits"](#).

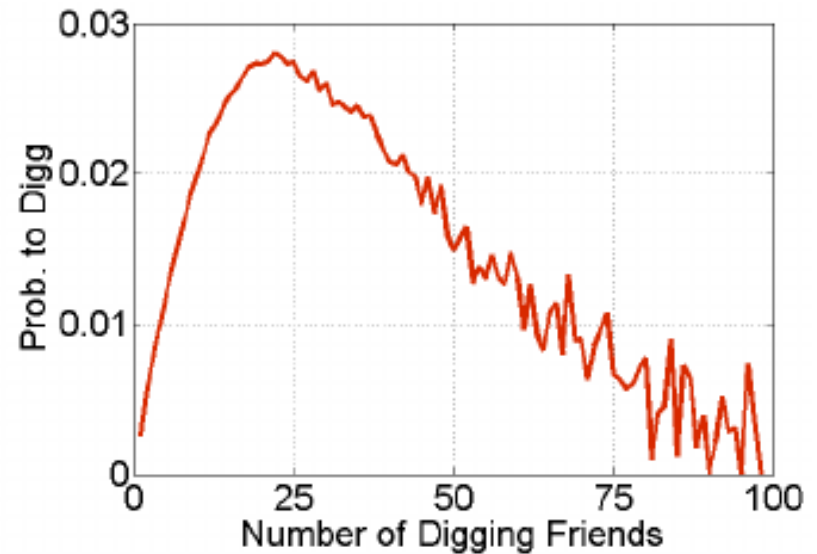
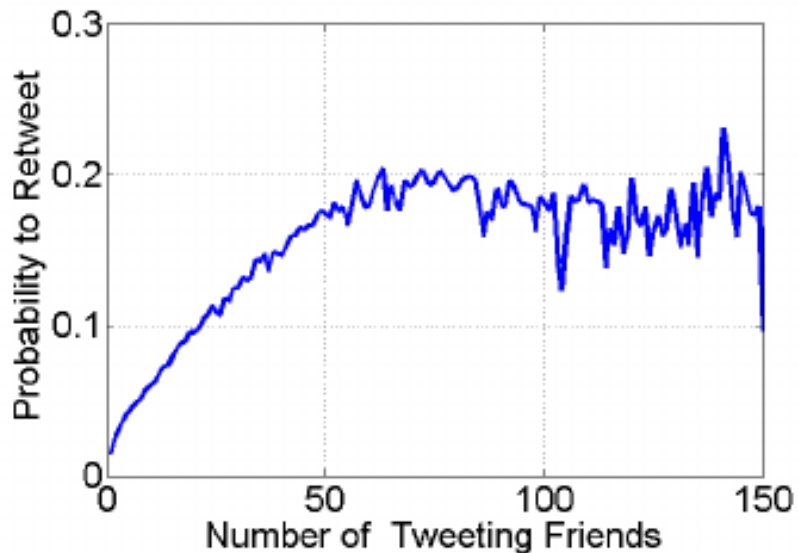


# Online Social Impact: immediacy

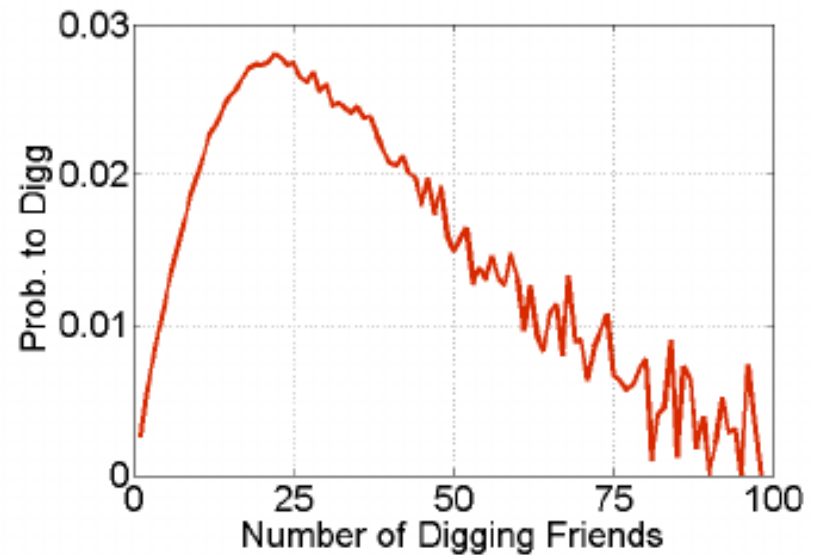
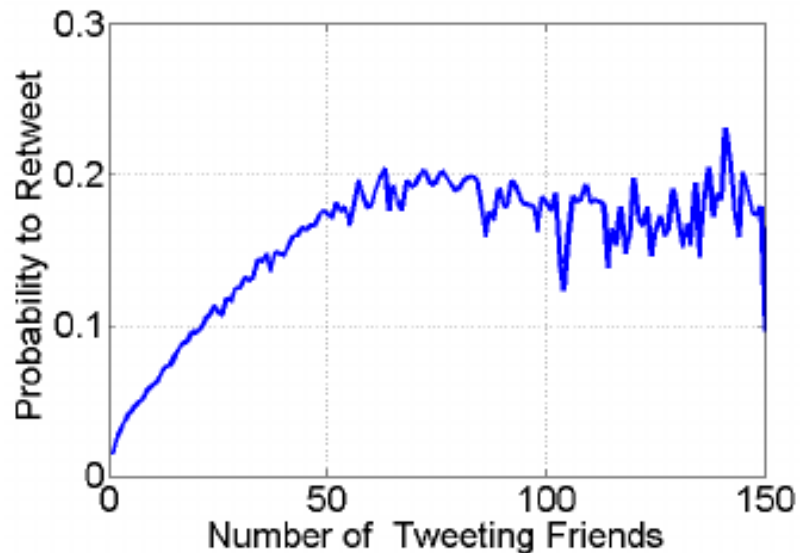


# Limits to the psychosocial law

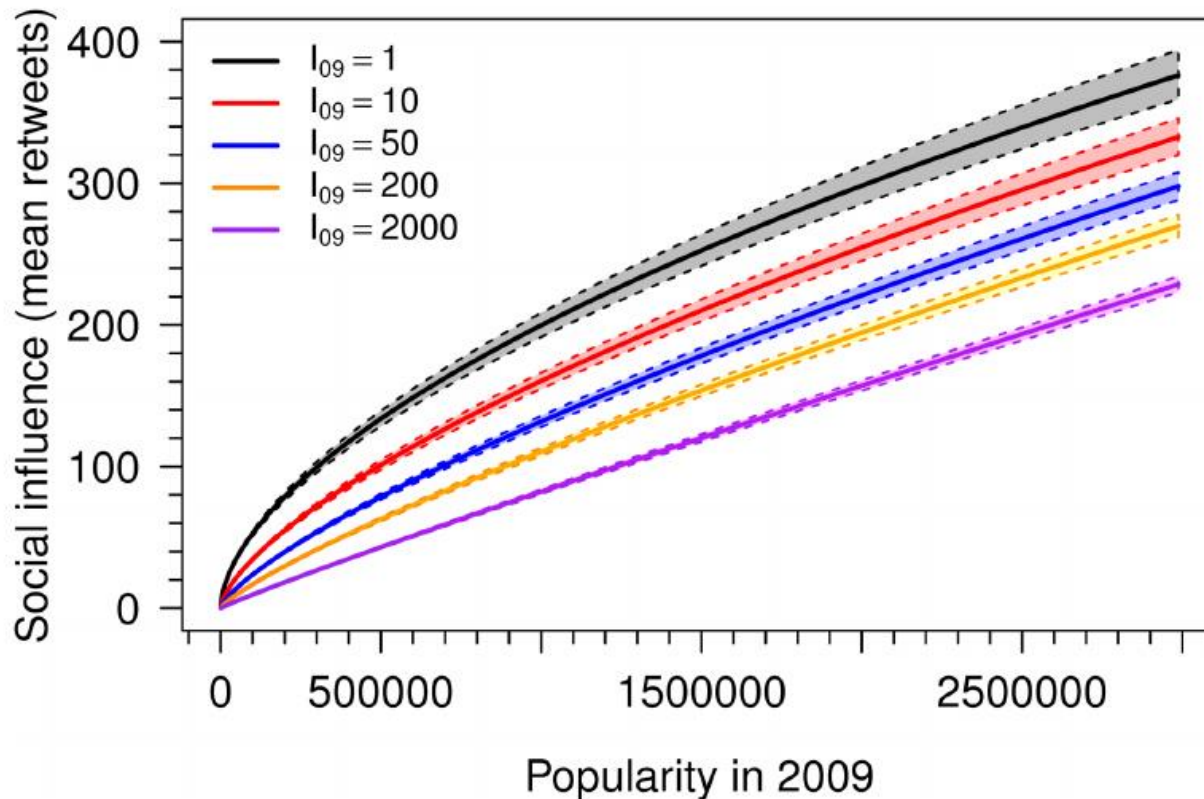
The extent of impact grows monotonically with the number of exposures and shows diminishing returns.



# Online information spreading is different from a virus spreading! (simple contagion vs. complex contagion)



# Division of impact in online social networks



Garcia, David, et al. "Understanding popularity, reputation, and social influence in the Twitter society." *Policy & Internet* 9.3 (2017): 343-364.

---

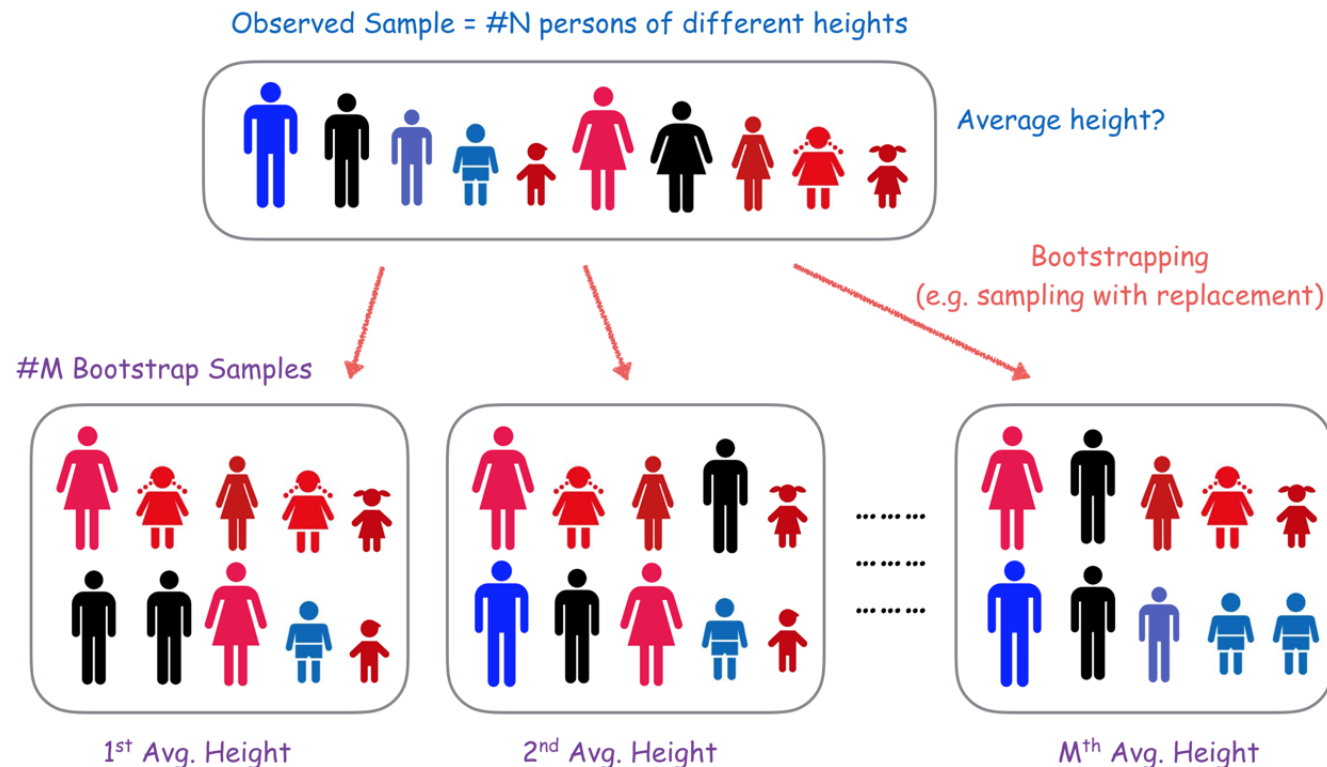
Part 3

# **METHOD: BOOTSTRAPPING**

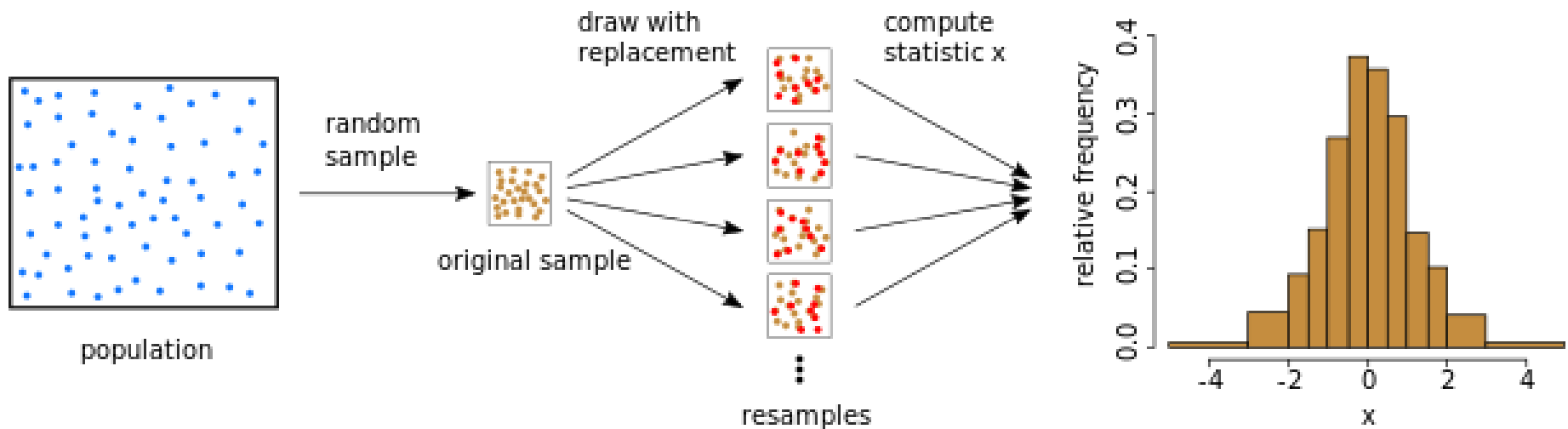
# Assessing uncertainty via bootstrapping

Bootstrap simulates the sampling of our original data.

To bootstrap, we resample from our sample by generating new samples of the same size as our original sample **with replacement**



# Bootstrapping logic



Source: Wikipedia

## Example: the mean of a variable

First, we load the data and measure the mean over our sample. We will use the height Data from **National Health Interview Survey (NHIS) 2007**.

The first few heights in the dataset look like this (inches):

74 70 61 68 66 98

With the mean height over the sample being **69.5782654 inches**.

To generate a bootstrap sample we should resample once with replacement and compute the mean over the resulting sample. An example of a bootstrap mean is 69.5423197 inches.



## Running the resampling

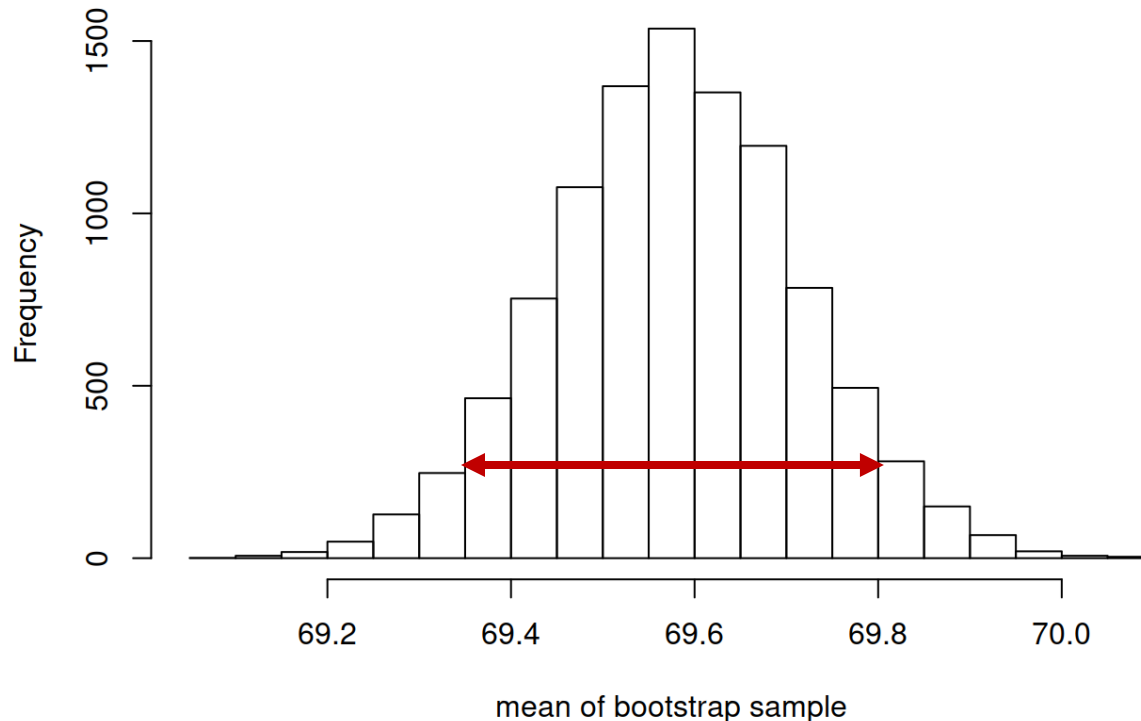
Now we can repeat the bootstrap sample and measurement a lot of times, here we do it 10000 with a loop, saving the results in a vector. The vector will look like this:

69.85601 69.59352 69.62717 69.5302 69.62717 69.59415

Over the results, we can now see the **median**, which is the point that separates 50% of the results on one side and 50% on the other. In this case the median is **69.5760711** inches.

# Uncertainty in the measure

Histogram of means measured over each bootstrap sample



95% of the examples fell between 69.3166092 and 69.8453553, this is called the **95% confidence interval**.

**We can be confident that the mean we calculated 69.5782654 inches is reliable measure.**

## References and further reads

Slides are based on David Garcia's lecture and material on Github

Latané, B. (1981). The psychology of social impact. *American psychologist*, 36(4), 343.

Latané, Bibb, and Sharon Wolf. "The social impact of majorities and minorities." *Psychological Review* 88.5 (1981): 438.