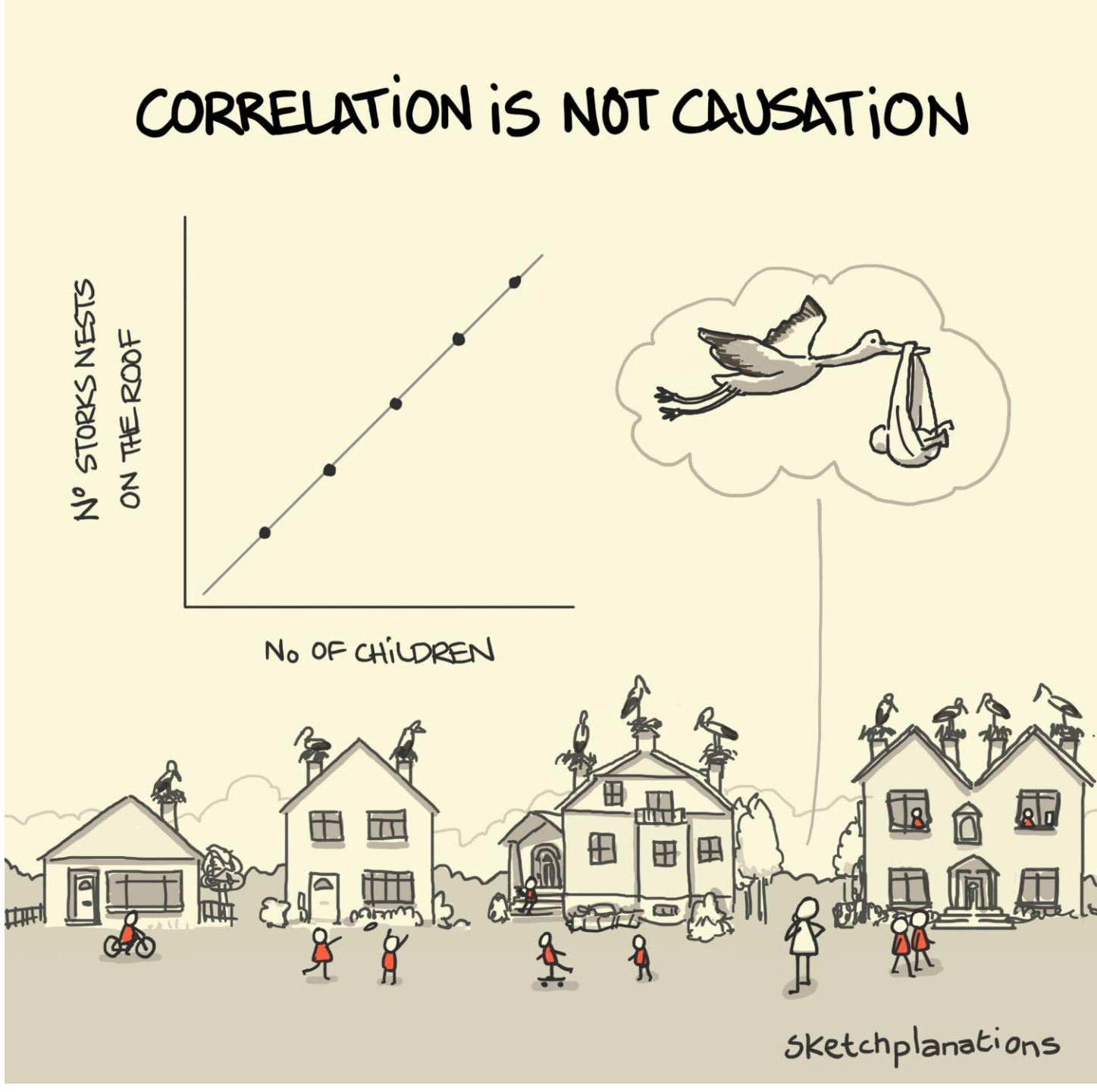
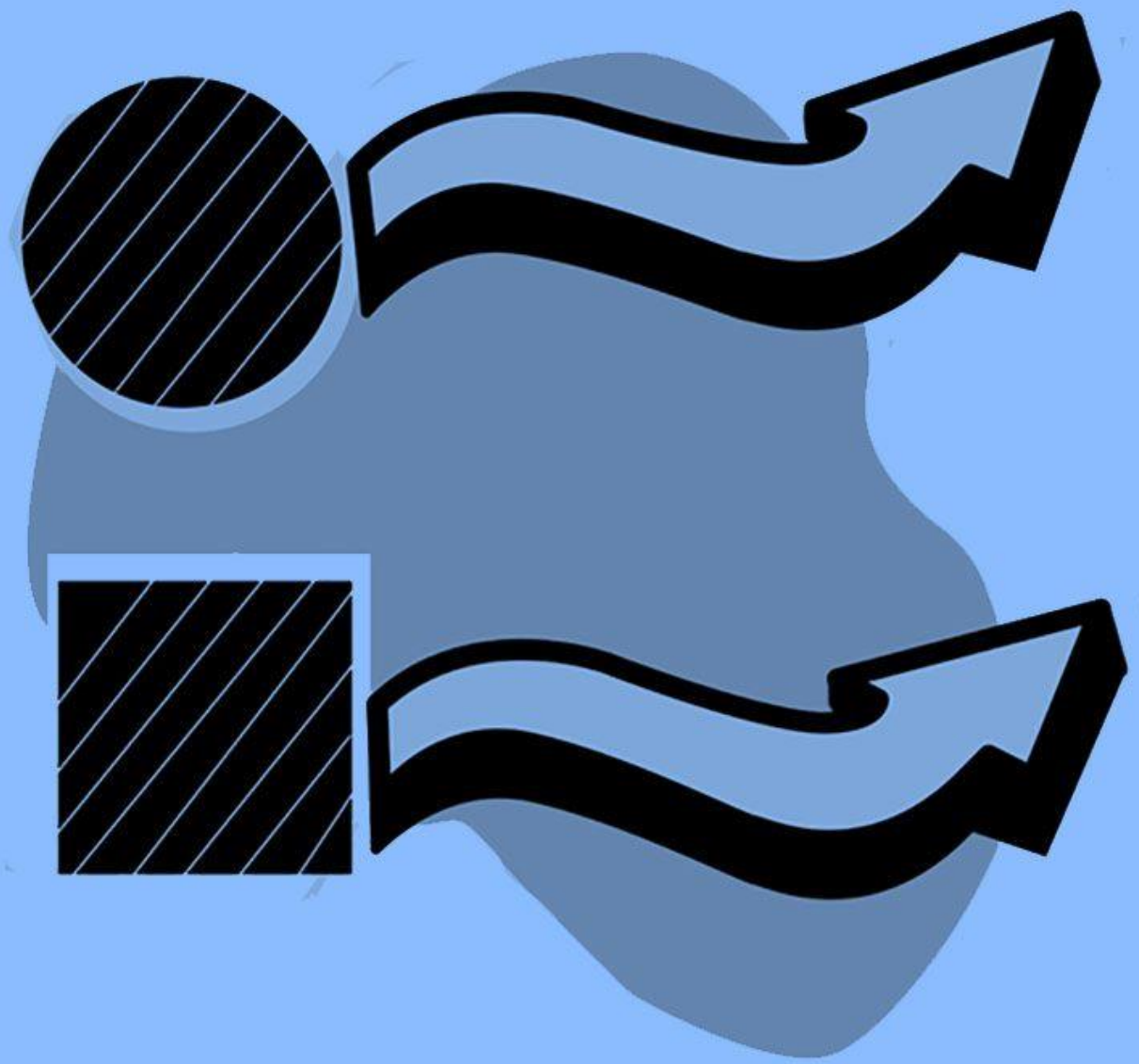
Causal Relationships

Positive, Negative Correlations





Correlation

[, kor-ə-ˈlā-shən]

Two variables move in relation to each other. They both move up OR one goes up when the other goes down.

Pearson's linear relationship types

Aka - Correlation Types OR Correlation Direction

Positive linear relationship

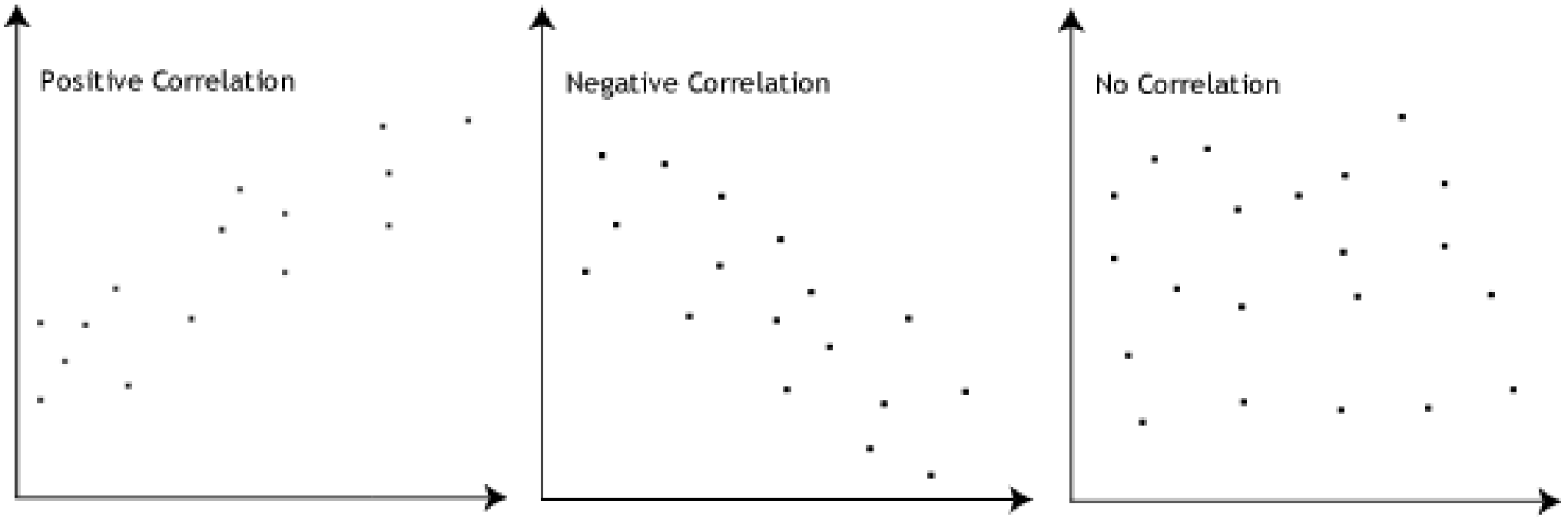
An example is a person's income that increases with age.

Negative linear relationship

An example is if a vehicle increases its speed, the time it takes to move decreases, and vice versa.

Learn more:

QuestionPro



- A positive correlation is a relationship between two variables where if one variable increases, the other one also increases.
- A negative correlation is a relationship between two variables where if one variable increases, the other one decreases.

Does each set of variables show a positive correlation, negative correlation, or no correlation? Explain your reasoning.

(a) The distance Angel swims and the time she takes
(b) The distance Angel swims and the time Dolores spends studying
(c) The temperature and the amount of clothing people wear
(d) The number of cats a dog sees and how often it barks
(e) The temperature in Vancouver and the temperature in Toronto
(f) The distance a jogger runs and the time the jogger runs

Correlation Coefficient

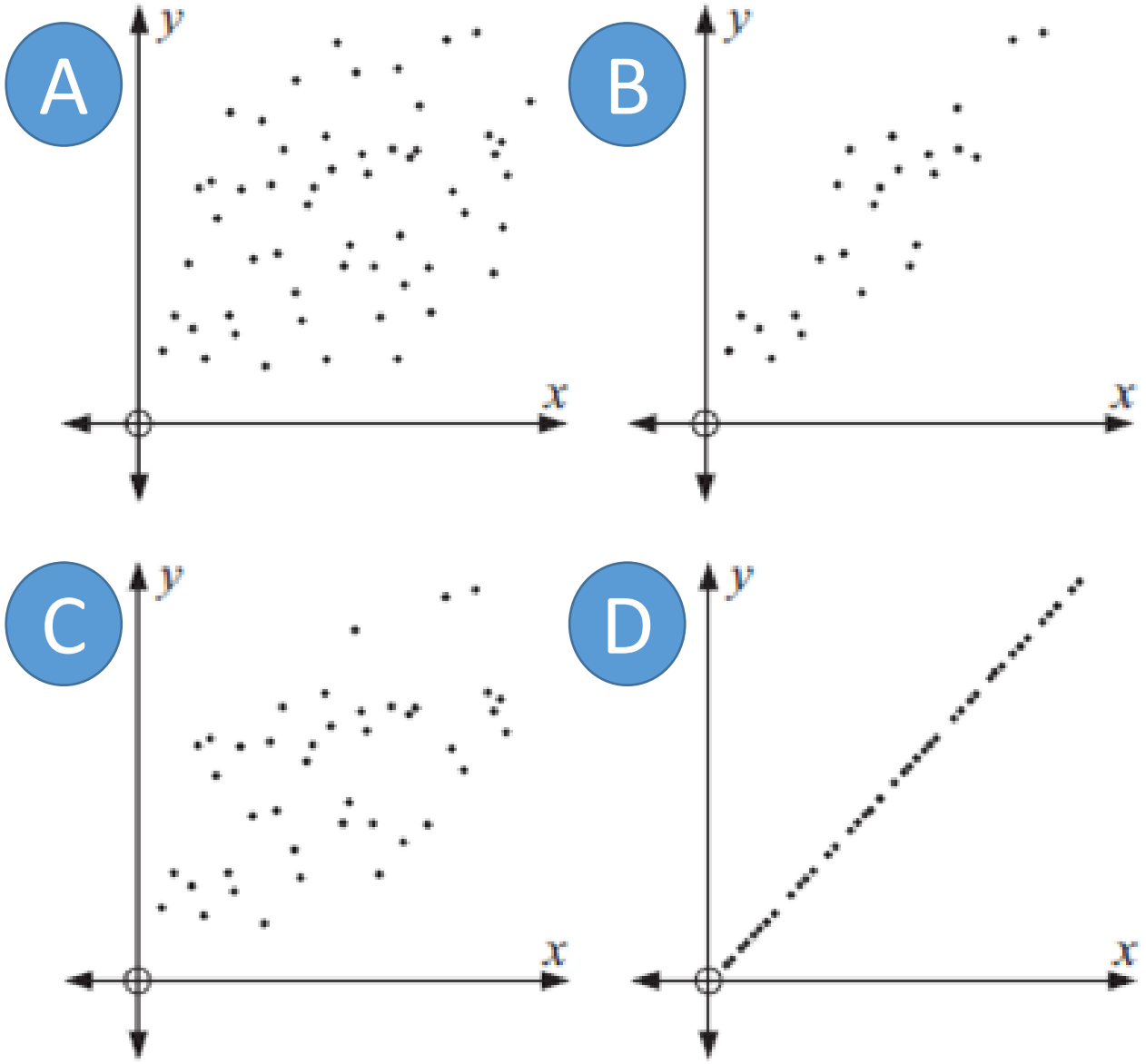
[ˌkór-ə-ˈlā-shən ˌkō-ə-ˈfi-shənt]

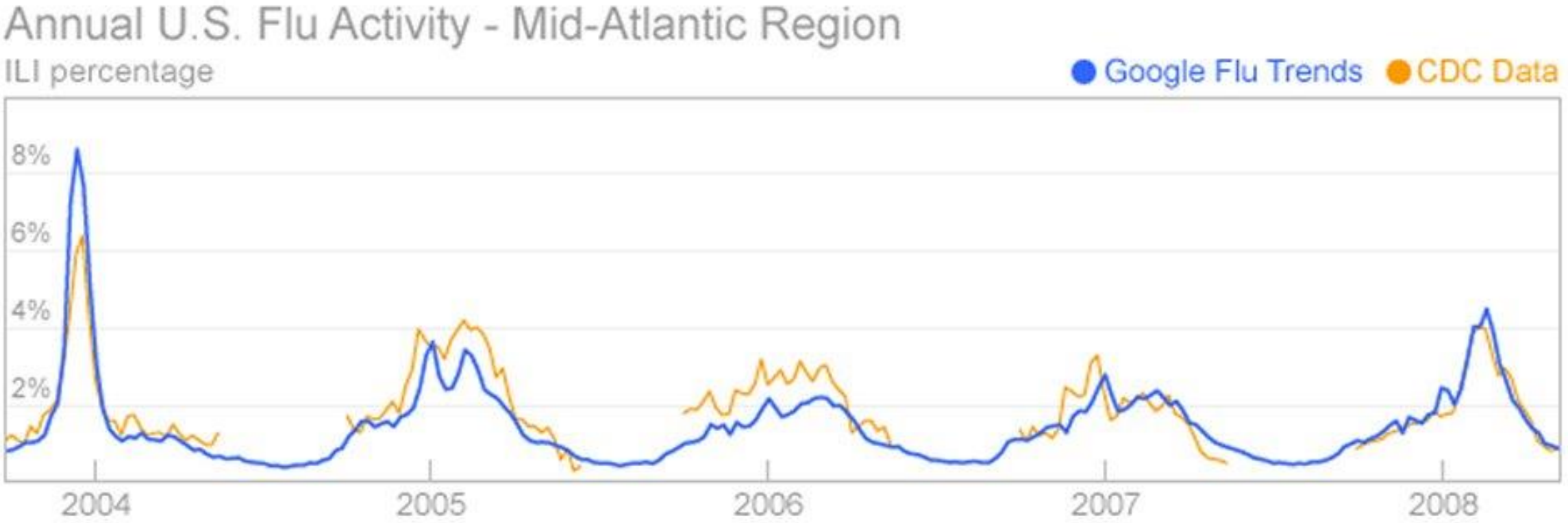
A statistical measure of the strength of the relationship between the relative movements of two variables.

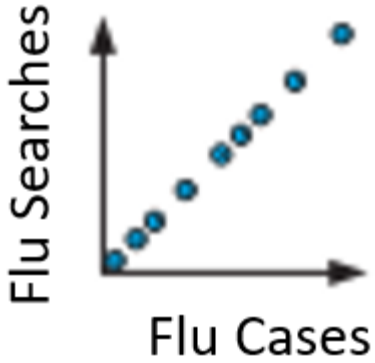
Put these graphs in order from weakest to greatest strength.

Strength of a Relationship

- A relationship between two variables is considered strong if the data is closely grouped around a line of best fit.





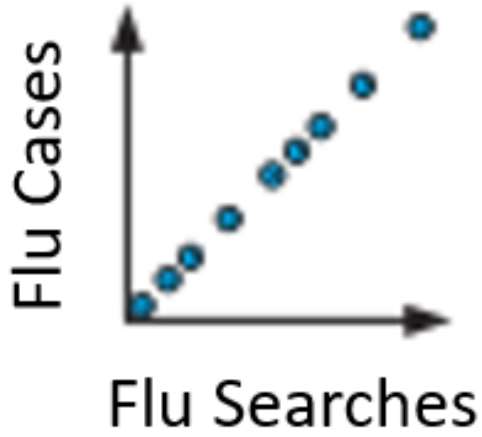


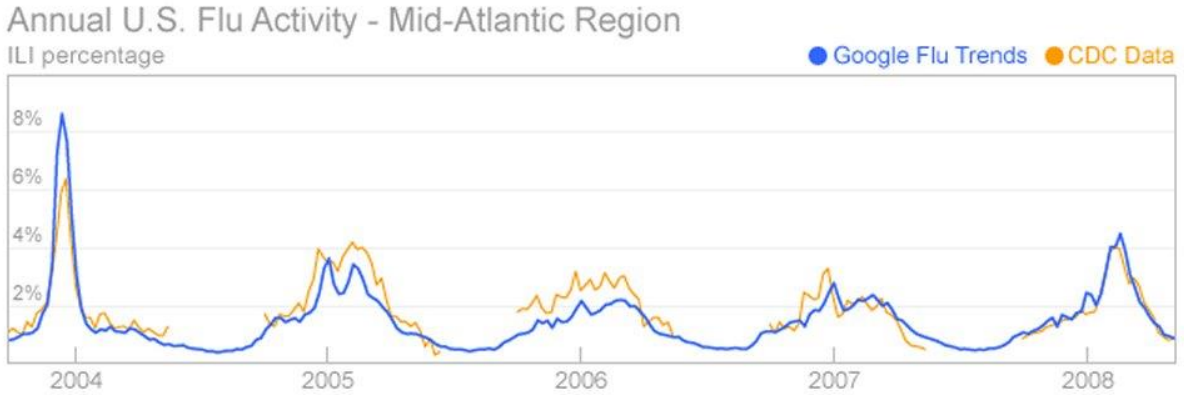
As the number of flu cases (X) increases,
the number of flu searches (Y) also increases.

They are positively correlated.

When two things are correlated, one of three things is happening:

1. X causes Y (causation)
2. Y causes X (reverse-causation)
3. Z causes X and Y (spuriousness)





↑ flu cases (X) → ↑ flu searches (Y).

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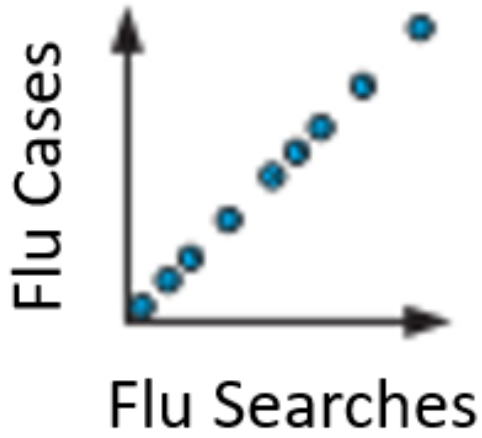

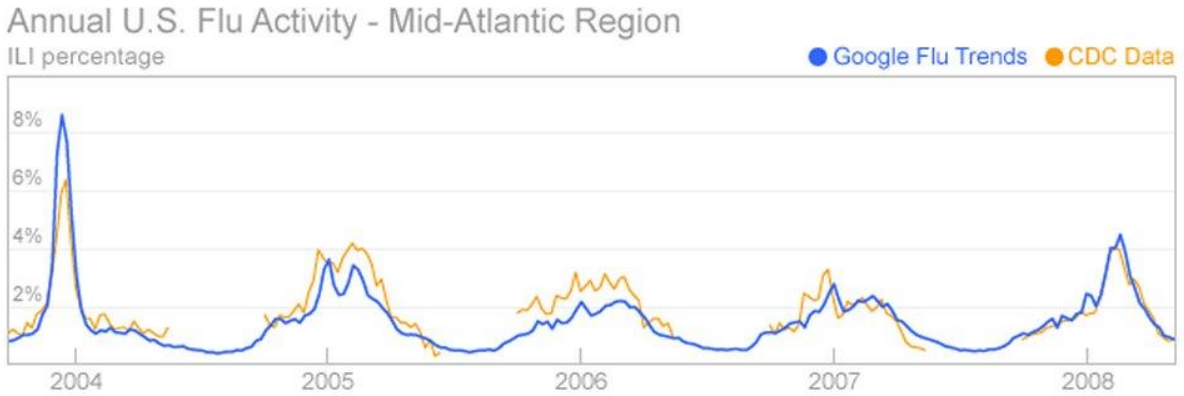

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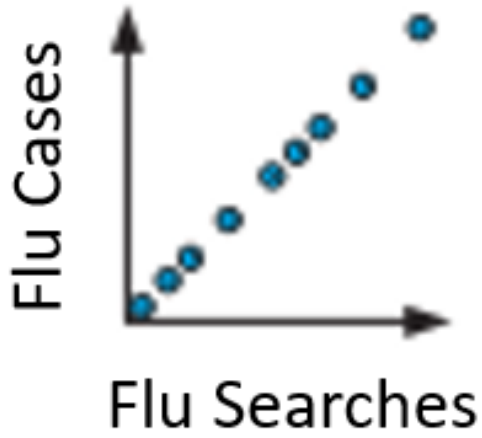

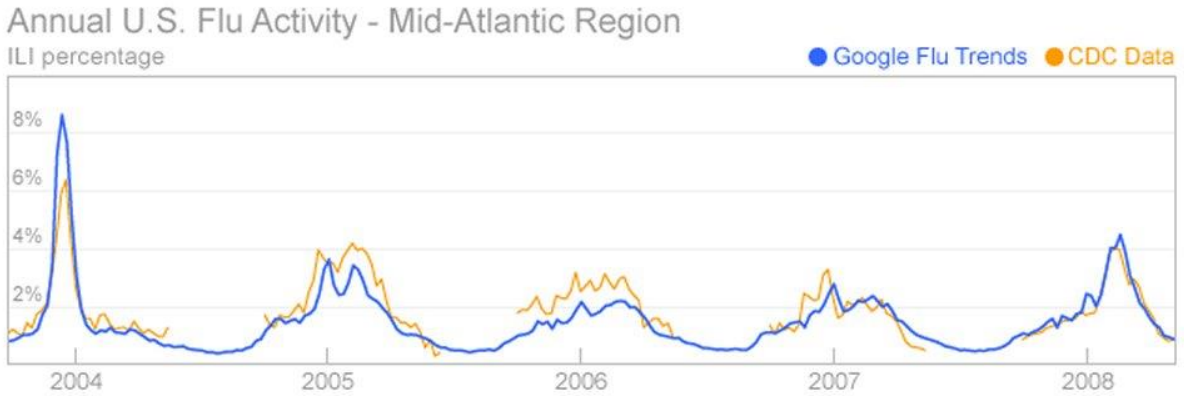

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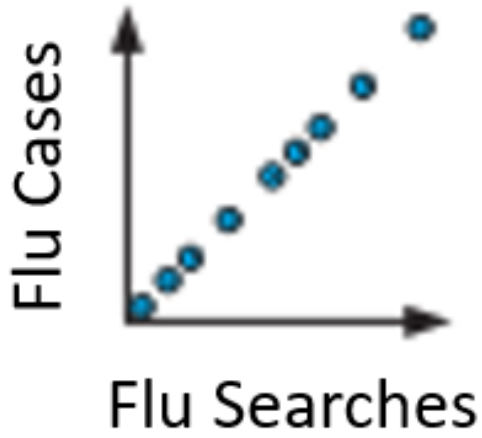

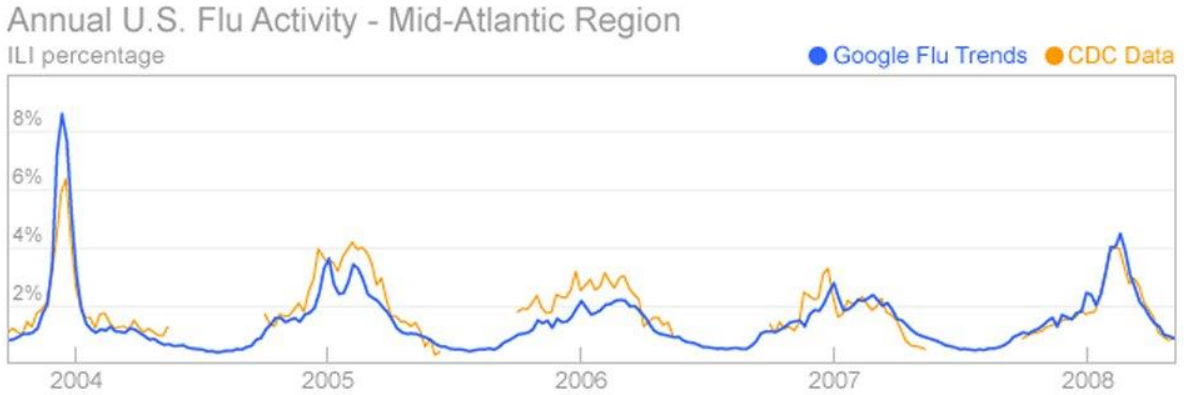

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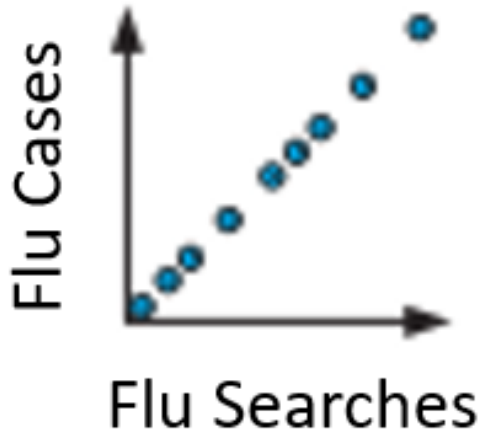

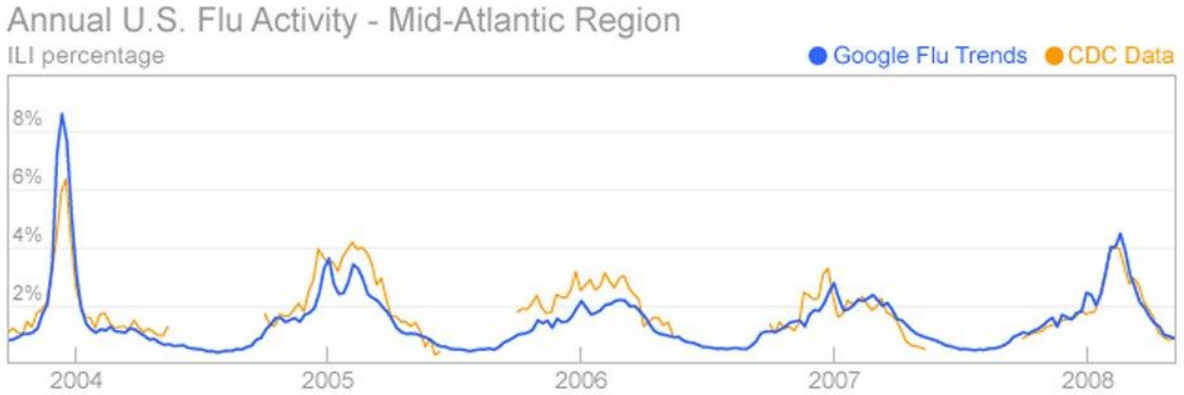

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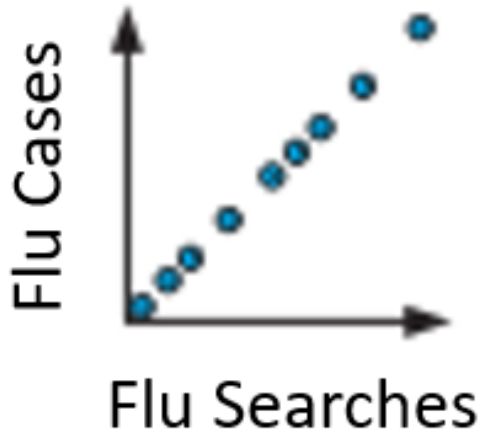
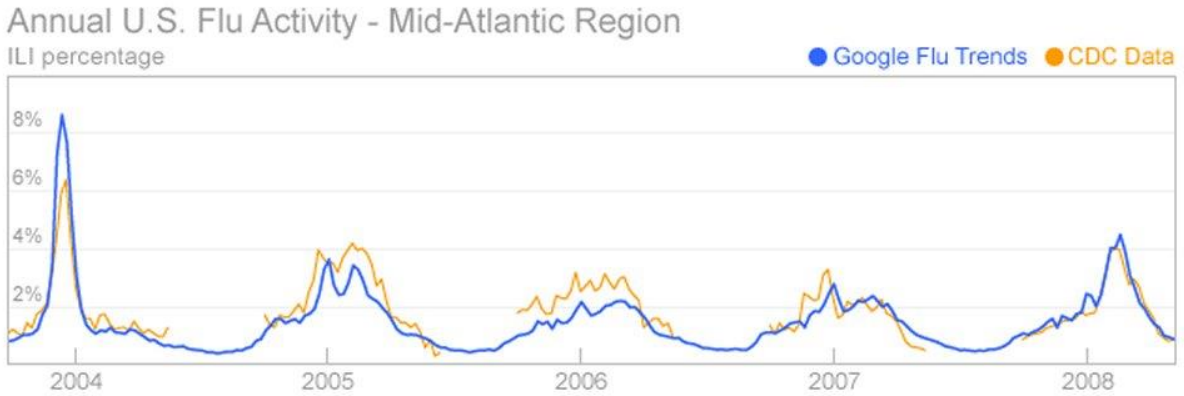
This means one of the following is happening:
(1) ↑Flu cases (X) is causing ↑Flu searches (Y)
(2) ↑Flu searches (Y) is causing ↑Flu cases (X)
(3) A third factor is causing both ↑Flu cases (X) and ↑Flu searches (Y)





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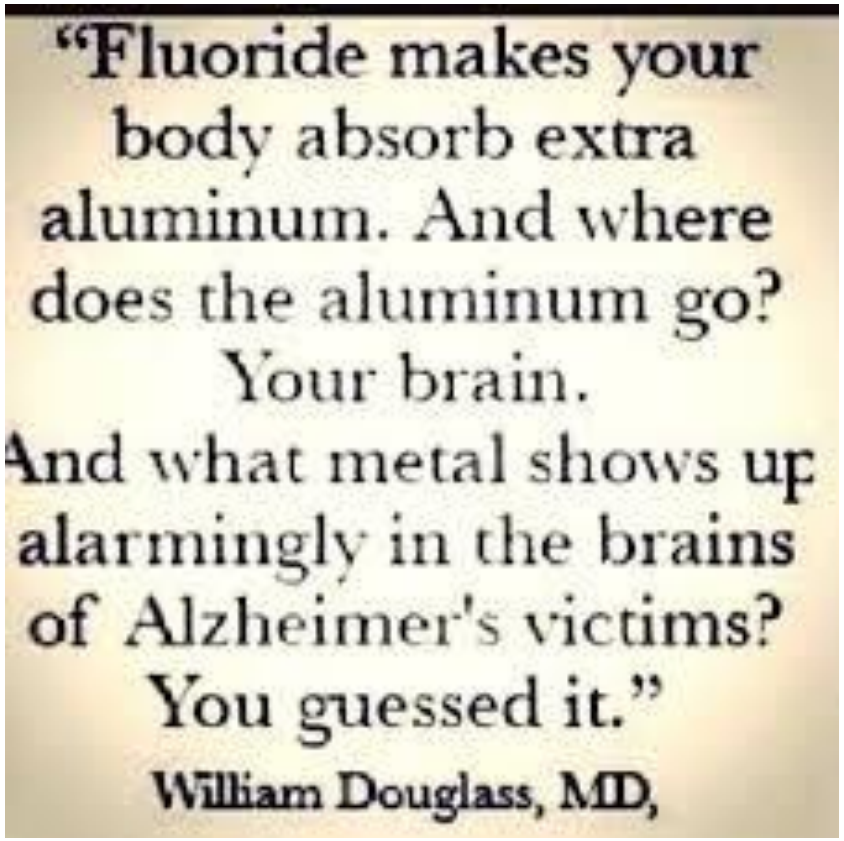
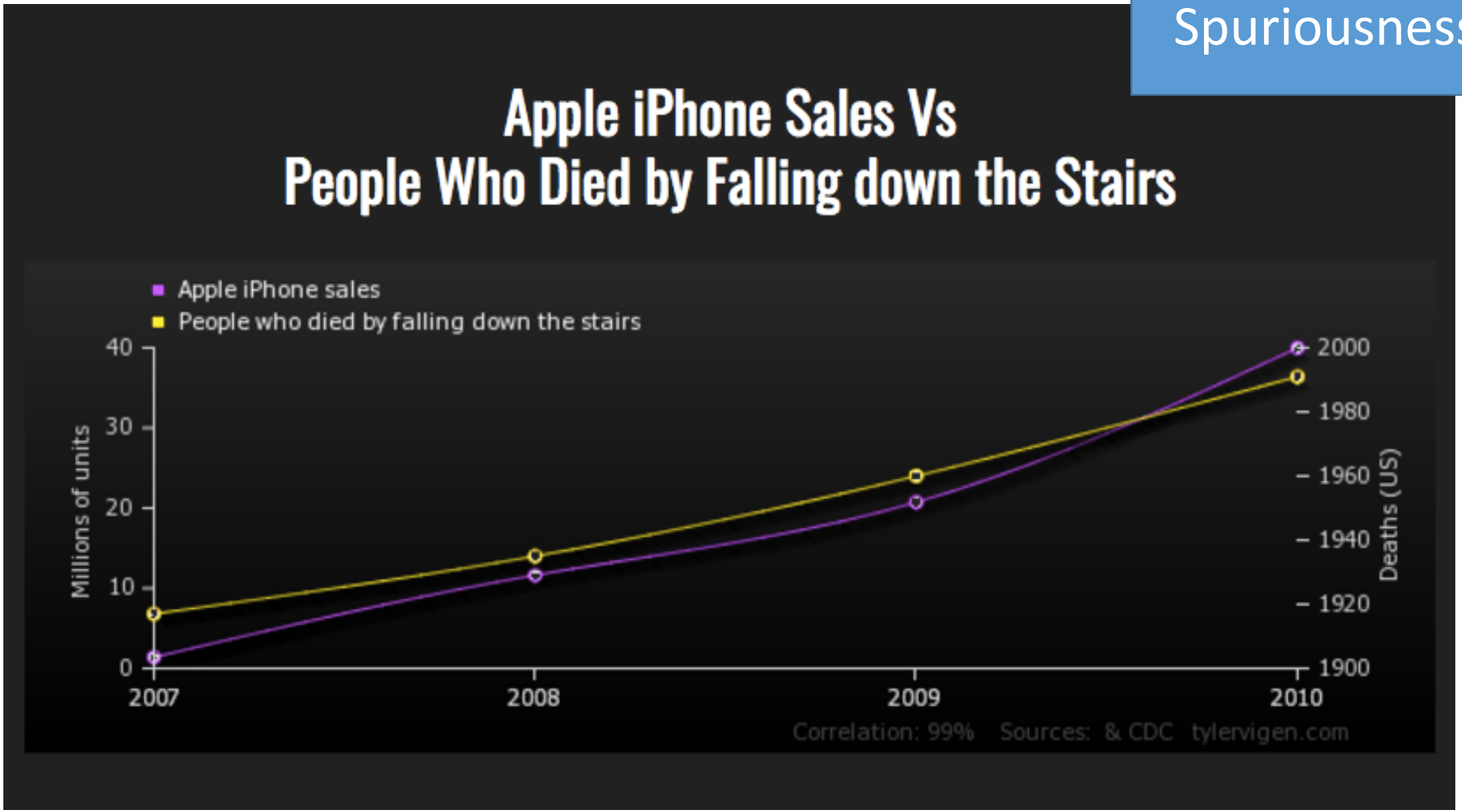
And we don't know which it is without replication, effective sampling and randomization.

Some evidence that it is reverse causation: Aluminum in brain is caused by Alzheimer's.



Spuriousness – third factor is causing both.

Spuriousness



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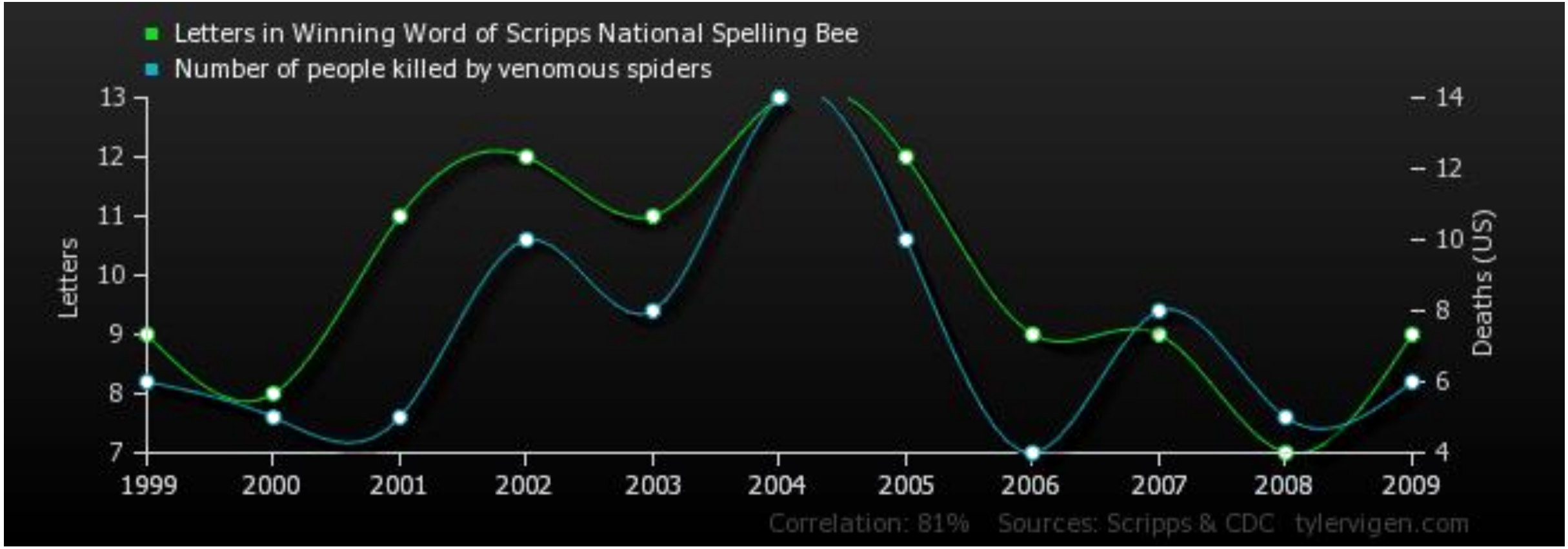
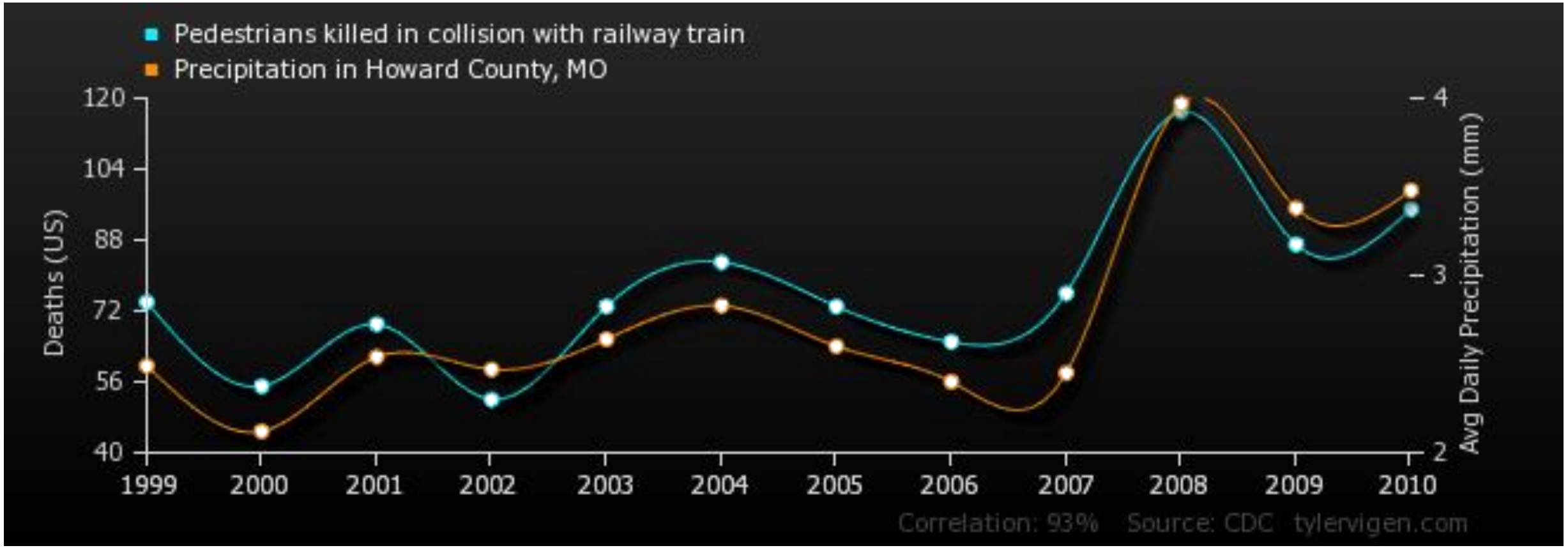
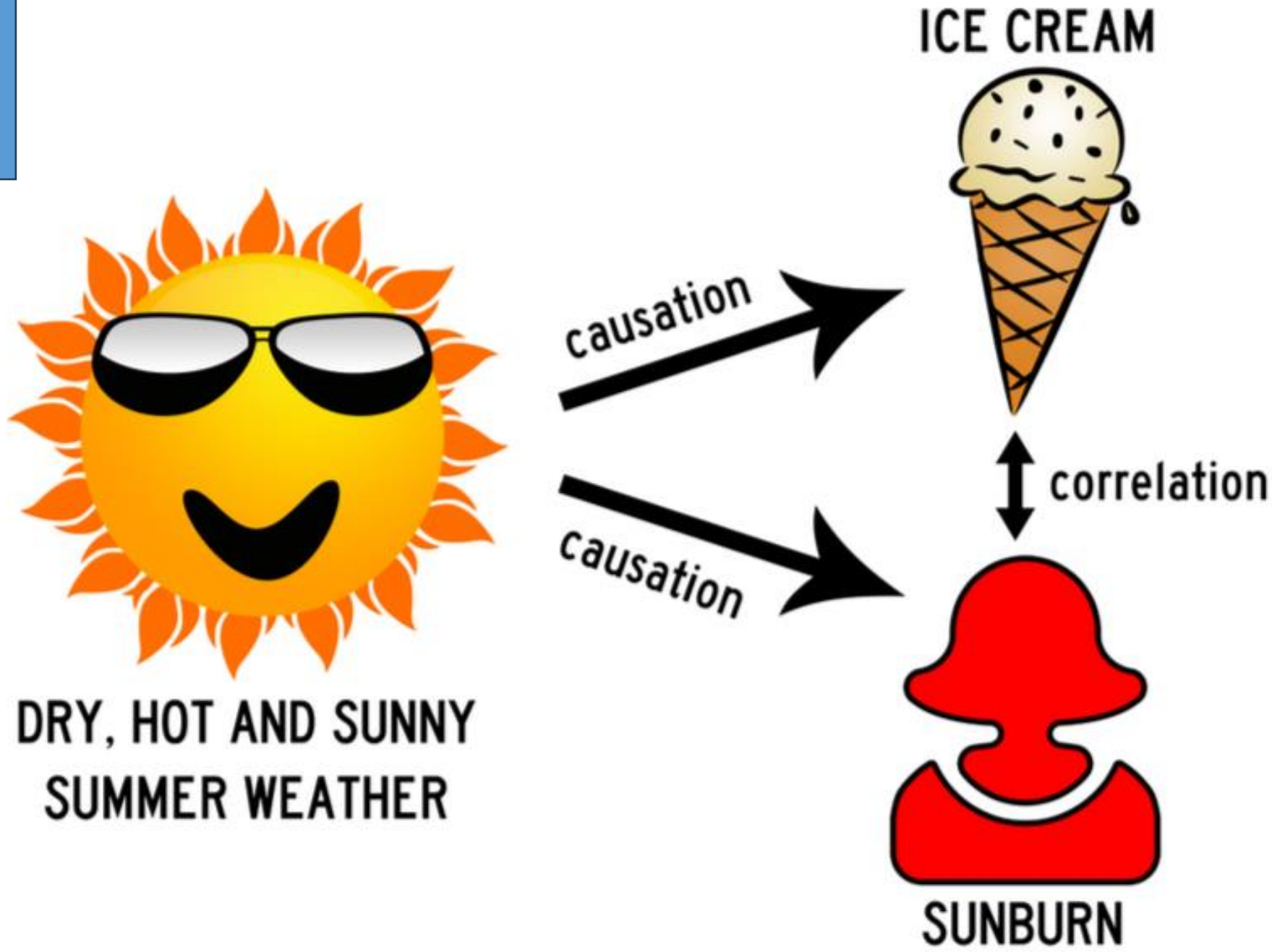


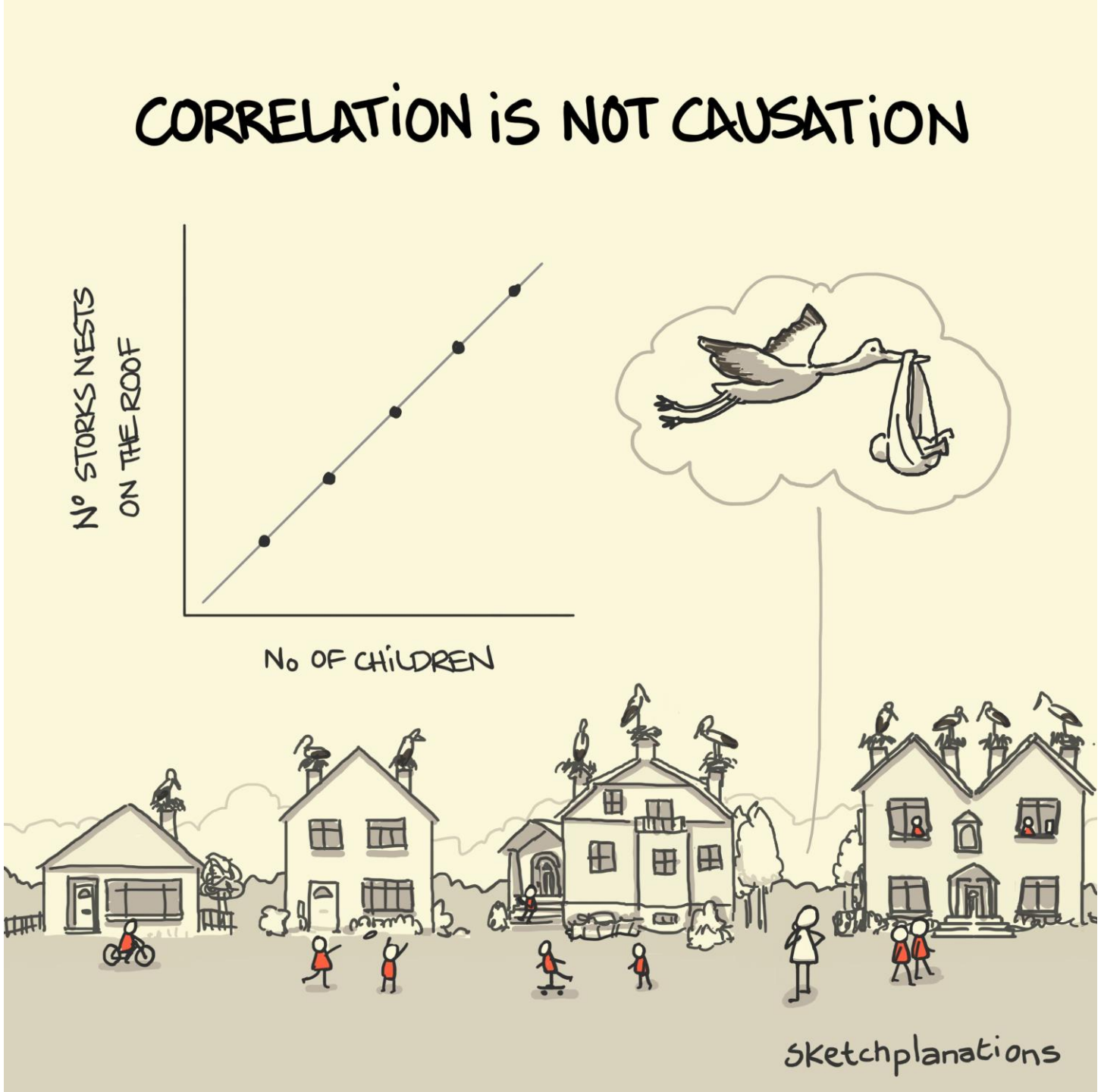
Spuriousness



Another diagram to describe it:



The opening diagram again.



To prove causation you need:

- A large sample size (replication)
- Random assignment
- Random sampling
- Control groups
- Double blinding
- A logical link between the variables.

A Frank Statement to Cigarette Smokers

RECENT REPORTS on experiments with mice have given wide publicity to a theory that cigarette smoking is in some way linked with lung cancer in human beings.

Although conducted by doctors of professional standing, these experiments are not regarded as conclusive in the field of cancer research. However, we do not believe that any serious medical research, even though its results are inconclusive should be disregarded or lightly dismissed.

At the same time, we feel it is in the public interest to call attention to the fact that eminent doctors and research scientists have publicly questioned the claimed significance of these experiments.

Distinguished authorities point out:

1. That medical research of recent years indicates many possible causes of lung cancer.

2. That there is no agreement among the authorities regarding what the cause is.

3. That there is no proof that cigarette smoking is one of the causes.

4. That statistics purporting to link cigarette smoking with the disease could apply with equal force to any one of many other aspects of modern life. Indeed the validity of the statistics themselves is questioned by numerous scientists.

We accept an interest in people's health as a basic responsibility, paramount to every other consideration in our business.

We believe the products we make are not injurious to health.

We always have and always will cooperate closely with those whose task it is to safeguard the public health.

For more than 300 years tobacco has given solace, relaxation, and enjoyment to mankind. At one time or another during those years critics have held it responsible for practically every disease of the human body. One by one these charges have been abandoned for lack of evidence.

Regardless of the record of the past, the fact that cigarette smoking today should even be suspected as a cause of a serious disease is a matter of deep concern to us.

Many people have asked us what we are doing to meet the public's concern aroused by the recent reports. Here is the answer:

1. We are pledging aid and assistance to the research effort into all phases of tobacco use and health. This joint financial aid will of course be in addition to what is already being contributed by individual companies.
2. For this purpose we are establishing a joint industry group consisting initially of the undersigned. This group will be known as TOBACCO INDUSTRY RESEARCH COMMITTEE.
3. In charge of the research activities of the Committee will be a scientist of unimpeachable integrity and national repute. In addition there will be an Advisory Board of scientists disinterested in the cigarette industry. A group of distinguished men from medicine, science, and education will be invited to serve on this Board. These scientists will advise the Committee on its research activities.

This statement is being issued because we believe the people are entitled to know where we stand on this matter and what we intend to do about it.

TOBACCO INDUSTRY RESEARCH COMMITTEE

5400 EMPIR

THE AMERICAN TOBACCO C
Paul M. Hahn, P

BENSON &
Joseph F. Cull

BRIGHT BELT WA
F. S. R

BROWN & WILLIAM
Timothy V.

BURLEY AUCTION W
Albert Cle

How can you tell who is telling the truth?

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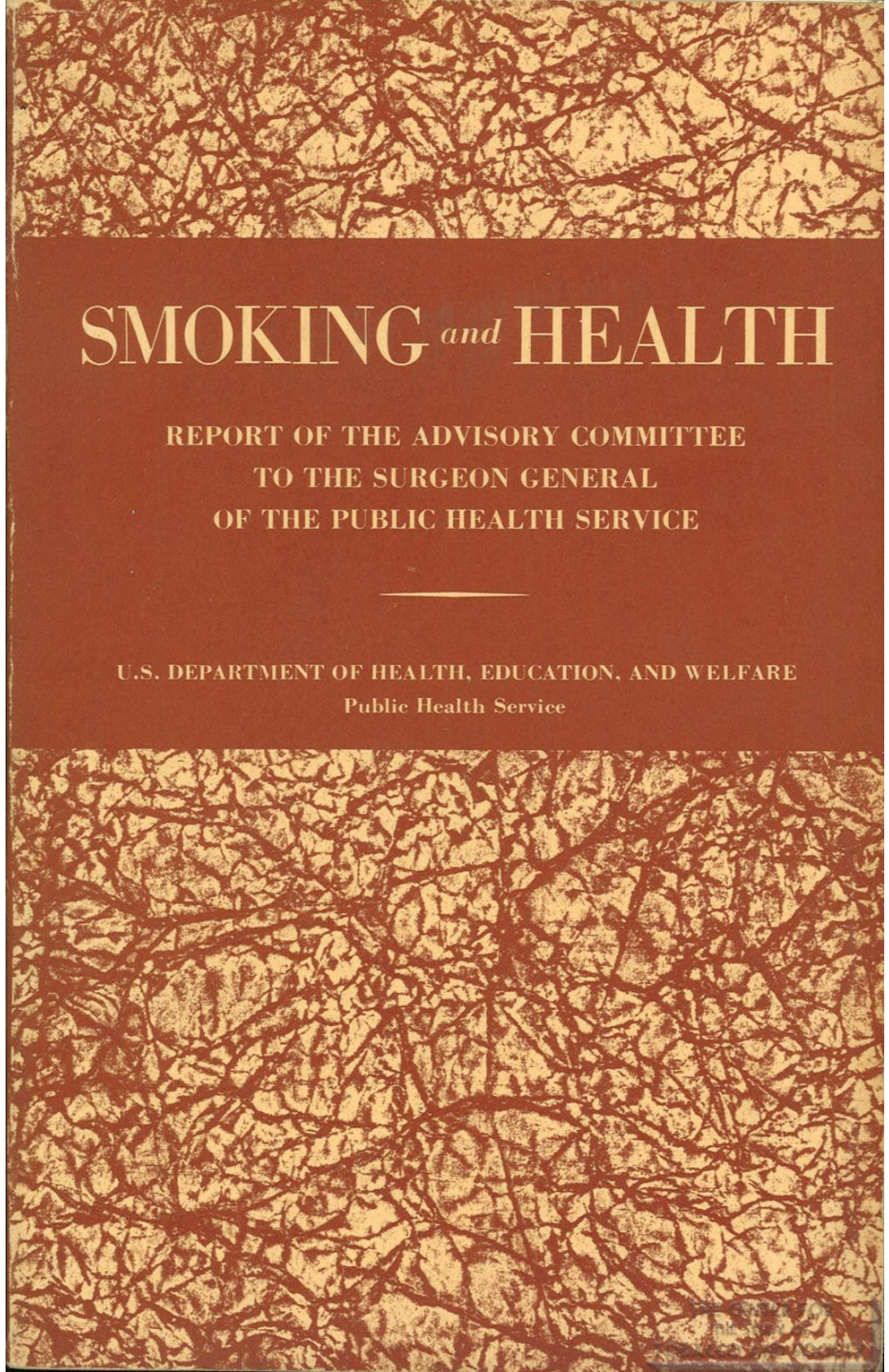


In 1964, the Surgeon General, released the landmark report linked smoking cigarettes with dangerous health effects, including lung cancer and heart disease.

Just one year after the report's initial release, Congress passed the Federal Cigarette Labeling and Advertising Act of 1965, which required the first warning labels on cigarette packages.

What New York Doctors Think of Smoking

By RICHARD BARR

Will the report of the U. S. Public Health Service, showing a link between cigaret smoking and lung cancer, cause New York doctors to give up cigarets?

It will and it won't.

Medical men here appear to have been convinced of the harm of heavy smoking even before the Public Health Service report, but quite a few of them say they will go on smoking just the same.

Of course, they'll tell their patients to ease up on their smoking or cut it out altogether.

Here are the results of a canvass of New York doctors on whether the U. S. Public Health Service report will influence their own use of tobacco:

Dr. Eric Andreae, 1129 Madison ave., chest disease specialist at St. Luke's Hospital and assistant physician at Knickerbocker Hospital:

"I'm not a heavy smoker, about half a pack a day. The Federal report won't make me quit.

"But I definitely know that cigaret smoking is connected with cancer. I

Turn to DOCTORS, Page 8

"The U.S. Public Health Service report won't influence my smoking habits one bit. I haven't seen the report and I'm not going to read it.

"I love cigarets and I have no intention of giving them up. They make me cough and feel badly. I believe the warnings against cigarets are accurate.

"I tell my patients it's not healthy to smoke, and that excessive use is harmful. But so is too much food or driving a car in some circumstances.

"I may think others are idiots to go on smoking. But I see the cigaret sales rise every year. I'll continue just as I am."

Dr. Eugene Rappaport, Jamaica, Queens.

A COMPLETE TV MAGAZINE YOURS FREE

New York Journal American

SUNDAY EDITION

Today's Weather: Snow, sleet, freezing rain

No. 27,506 SUNDAY, JANUARY 12, 1964 SUNDAY 25 CENTS

THE CIGARET REPORT

Links Cancer, Other Diseases

See Here, Men, Eight Ashtrays for Five Smokers!

This is panel of 10 and two who headed committee on smoking. Of 10 on panel five smoke. Note eight ashtrays (circled).

WHO'S ON PANEL: Dr. Eugene H. Guthrie is at head of table at the right, staff director of a ten-man panel. Dr. James Hundley, Assistant U.S. Surgeon General and chairman of the group, is at head of table at the left. From left the 10 panelists are Dr. Maurice Harrison Seevers, University of Michigan; Dr. Walter J. Burdette, University of Utah; Dr. John Bamber Hickam, Indiana University; Dr. Emmanuel Farber, University of Pittsburgh; Dr. Stanhope Bayne-Jones; Drs. Hundley and Guthrie; Dr. Leonard M. Schuman, University of Minnesota; Dr. Charles Aubrey Lemaistre, University of Texas Southwestern Medical School; William G. Cochran, professor at Harvard; Dr. Louis Frederick Fieser, a professor at Harvard; and Dr. Jacob Furth of Columbia University.

But Statistics Are Disputed

The Dissent

By EMIL J. STEINHEUSER

Two doctors nationally known in the field of public health yesterday expressed extremely skeptical views on the value of the U.S. Public Health Service report on the relation between cigaret smoking and cancer.

One was Dr. Charles W. Mayo, son of one of the co-founders of the famed Mayo Clinic in Rochester, Minn.

CAN'T LEGISLATE

The other reached in a telephone poll by this newspaper was Dr. Harry S. Greene, chairman of the pathology department at Yale University in New Haven.

Said Dr. Mayo:

"I hear these things (statistics) all the time.

"I don't think you can legislate against tobacco any more

Turn to DISSENT, Page 6

The Report

By JACK PICKERING

WASHINGTON, Jan. 11.—A U.S. Government report today settled the worldwide argument over whether smoking is harmful.

It is harmful, a blue ribbon committee of scientists and doctors reported.

The opinoin was unanimous.

It may not stop the arguments, but it appears to leave no room for doubt, except the degree of danger.

It likewise seems certain to be followed by a government campaign against smoking—but there is no hint of a "prohibition law" against tobacco.

REPORT IN BRIEF

In brief, this is what the committee, chosen by the Surgeon General, Dr. Luther L. Terry, said today:

- There no longer is any doubt that cigarets cause lung cancer.
- There is evidence that several other diseases are influenced, if not positively caused, by smoking.
- The government, through the Public Health Service, already is studying "remedial measures."
- Educating the public, showing that it endangers its health by smoking, will be the essence of the campaign, but may not be all of it. Presen

Turn to SMOKING, Page 8

Editor's Report: States of Two Unions

By WILLIAM RANDOLPH HEARST JR.
Editor-in-Chief, The Hearst Newspapers

PRESIDENT JOHNSON'S State of the Union message this past week was basically a blueprint for making this great country an even greater one to live in. It was a forcefully-delivered demand upon the Congress for social legislation combining the outlooks of the Franklin D. Roosevelt New Deal and the John F. Kennedy New Frontier.

With its imposing list of progressive goals to be pursued with speed—ranging from civil rights to elimination of "pockets of poverty"—was a pruned budget and a cut-back in production of the material for nuclear weapons.

This was also interwoven with the top priority given the tax cut, so that new infusions of health and wealth can beef up the spending power of the individual and the employment power of industry.

W. R. HEARST JR.

It was a State of the Union which showed that—while not fancying our country as utopia—we still aim for the stars as did our ancestors who came from practically everywhere to build America.

I suppose no great ideal is ever fully achieved—but at least Americans are always striving for it. That way we manage to come closer than anywhere else on earth.

At about the same time the President was reporting on the state of the U. S., our Central Intelligence Agency (CIA) issued a trenchant and startling report on the state of the Union of Soviet Socialist Republics. It's in the worst state in years.

I think we ought to be happy that the state of our State is getting increasingly better than the state of the Communists' State. And this being the first time the CIA has made public its widely-gathered information, I for one welcome the word that it will continue. It is a forward step characteristic of its chief, my friend John McCone.

Turn to EDITOR'S REPORT, Page 2

GIs Use Tear Gas, Rout Panama Mob

PANAMA CITY, Jan. 11 (AP).—U.S. troops used tear gas at Colon today to force back a Panamanian mob throwing stones across the border into the Canal Zone.

The demonstrators, numbering about 200, rallied two or three blocks from the boundary, but did not immediately disband.

Before withdrawing, the men burned a switch house of the Panama Railroad in the area, the southwest corner of Colon, which is at the Caribbean end of the Canal.

Cross ties burned for about 25 feet along the tracks.

NOT SCHOOL BOYS

A Panamanian policeman trying to quiet the crowd was injured in a scuffle with a demonstrator.

The disorders lasted nearly four hours.

Maj. d Freedman, information officer for the U. S. Army southern command in the Canal Zone, said:

"There were adults in the crowd; these were not all schoolboys."

At the same time, Panama demanded that the first conditions for obtaining "a climate of negotiations" with the United States be the raising of Panama's national flag in the U. S. Canal Zone at all points where the U. S. flag is displayed.

Fabian Velarde, press secretary for President Roberto Chiari, said this information was given to a five-man mission from the Organization of American States (OAS) at its

Turn to PANAMA, Page 4

Smoking Report Is Size of Book

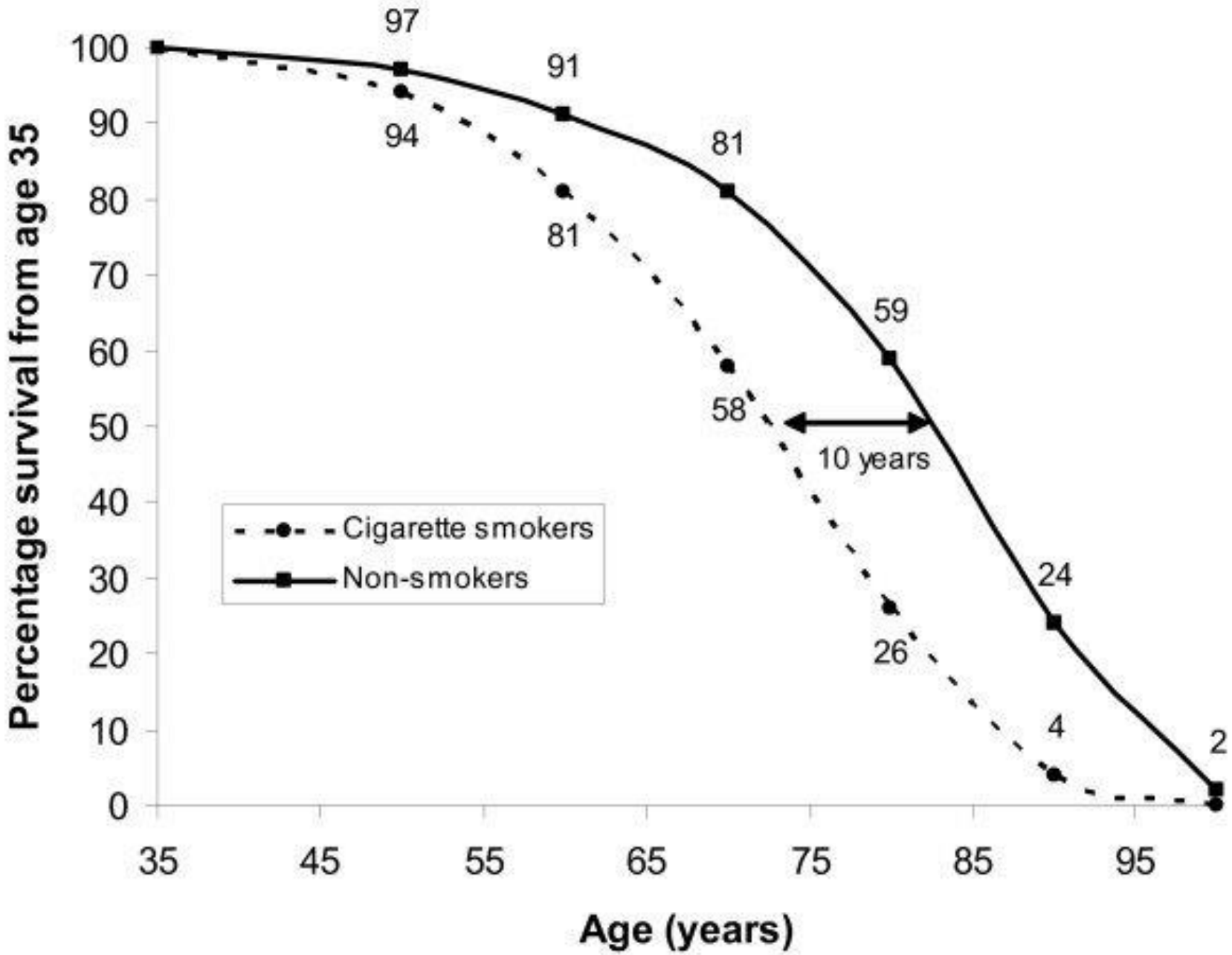
WASHINGTON, Jan. 11 (UPI).—The report of the Surgeon General's committee on smoking and health is about the size of an average book.

It is about nine inches high, six inches wide and one inch thick. It weighs more than 1½ pounds and has several hundred pages.

Today in the Journal-American:

The Latest Playtime Fashions—Page 29
The Moments of Decision by Andre Maurois—Page 31

Famous Front Pages–A Fascinating Historic Series Begins Today on Page 17 (Save Them All)

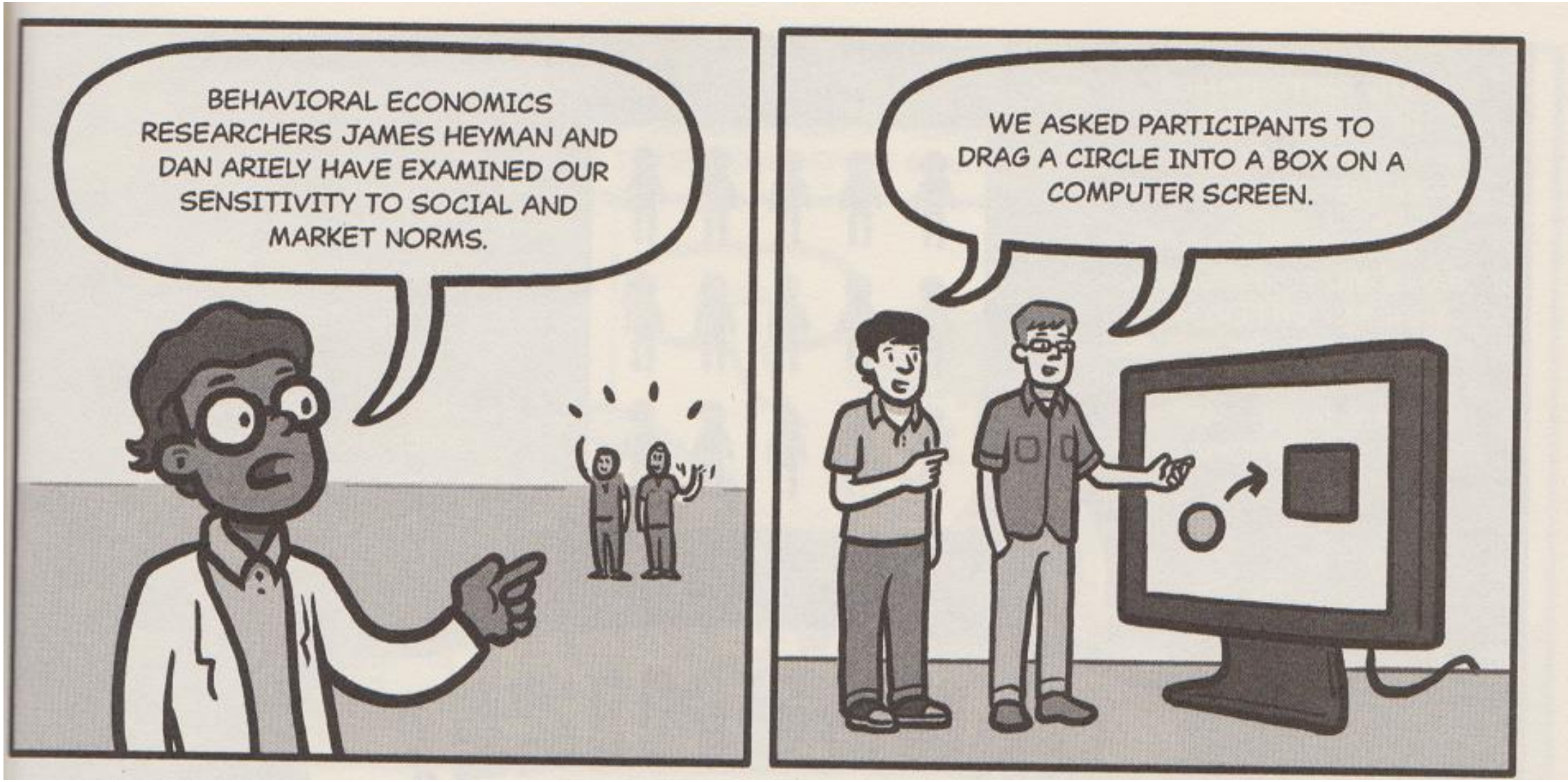


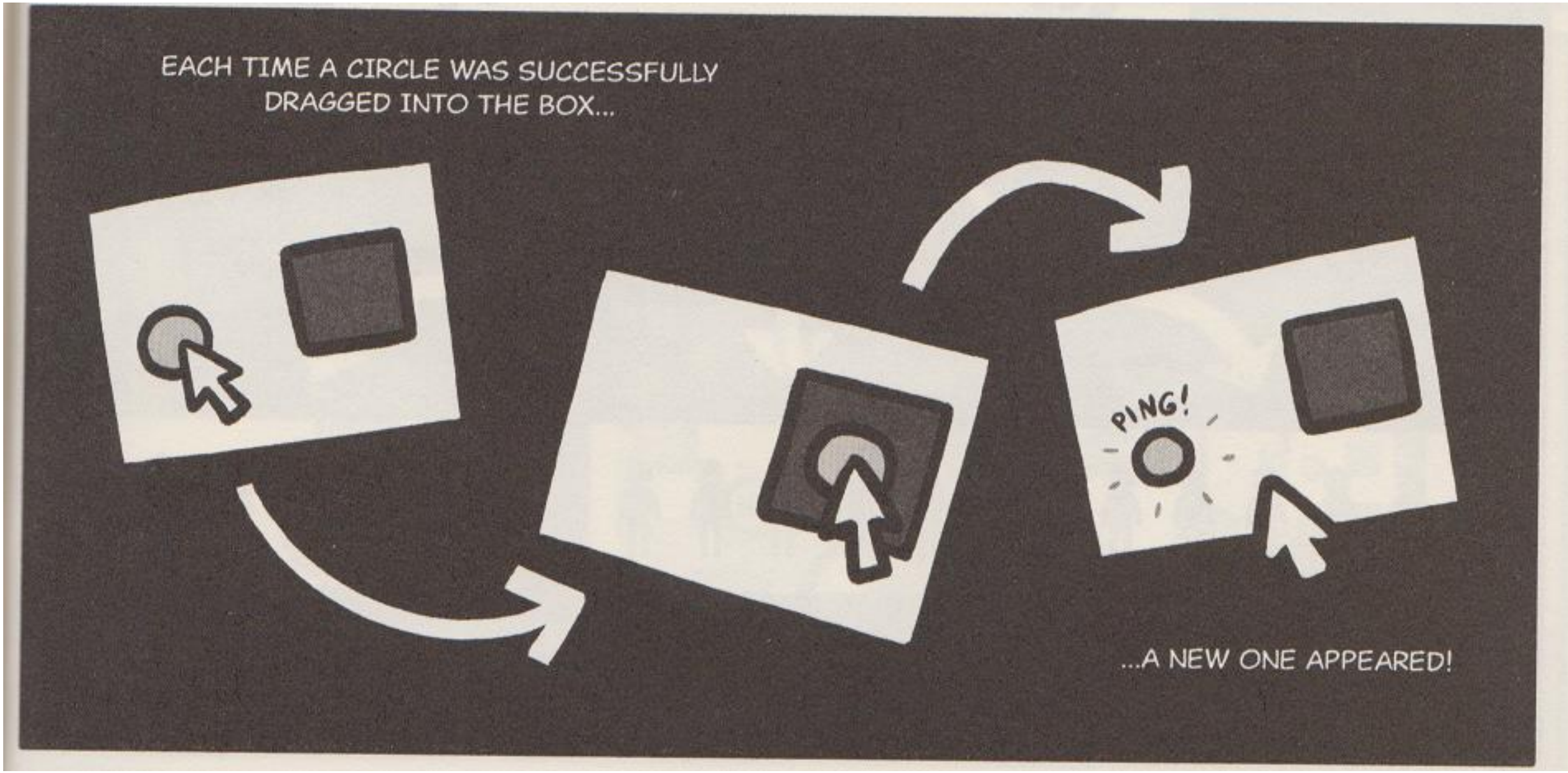
Because of the incredible power of the tobacco lobby, smoking and cancer have some of the strongest causal research that has ever occurred.

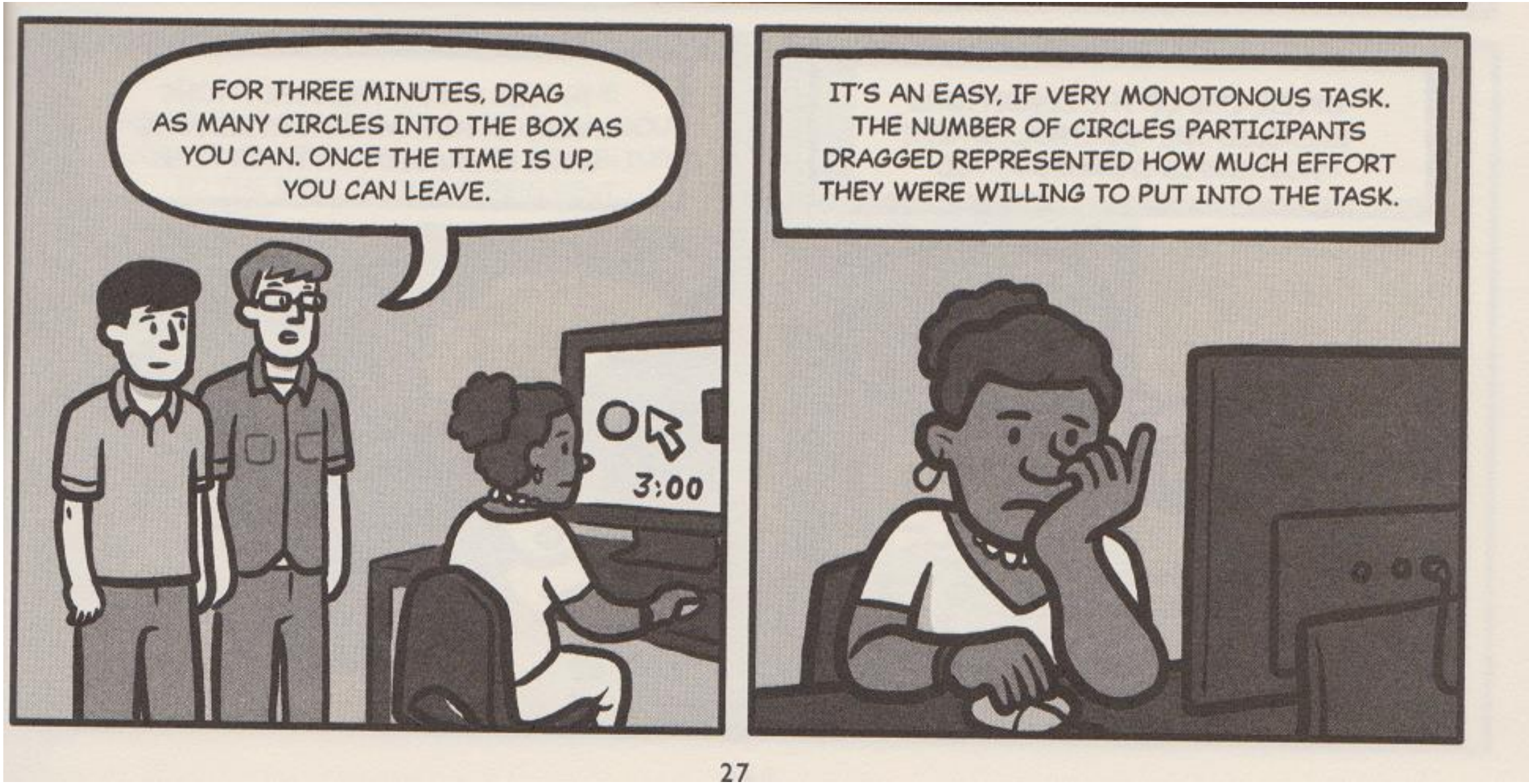
Smoking causes cancer.

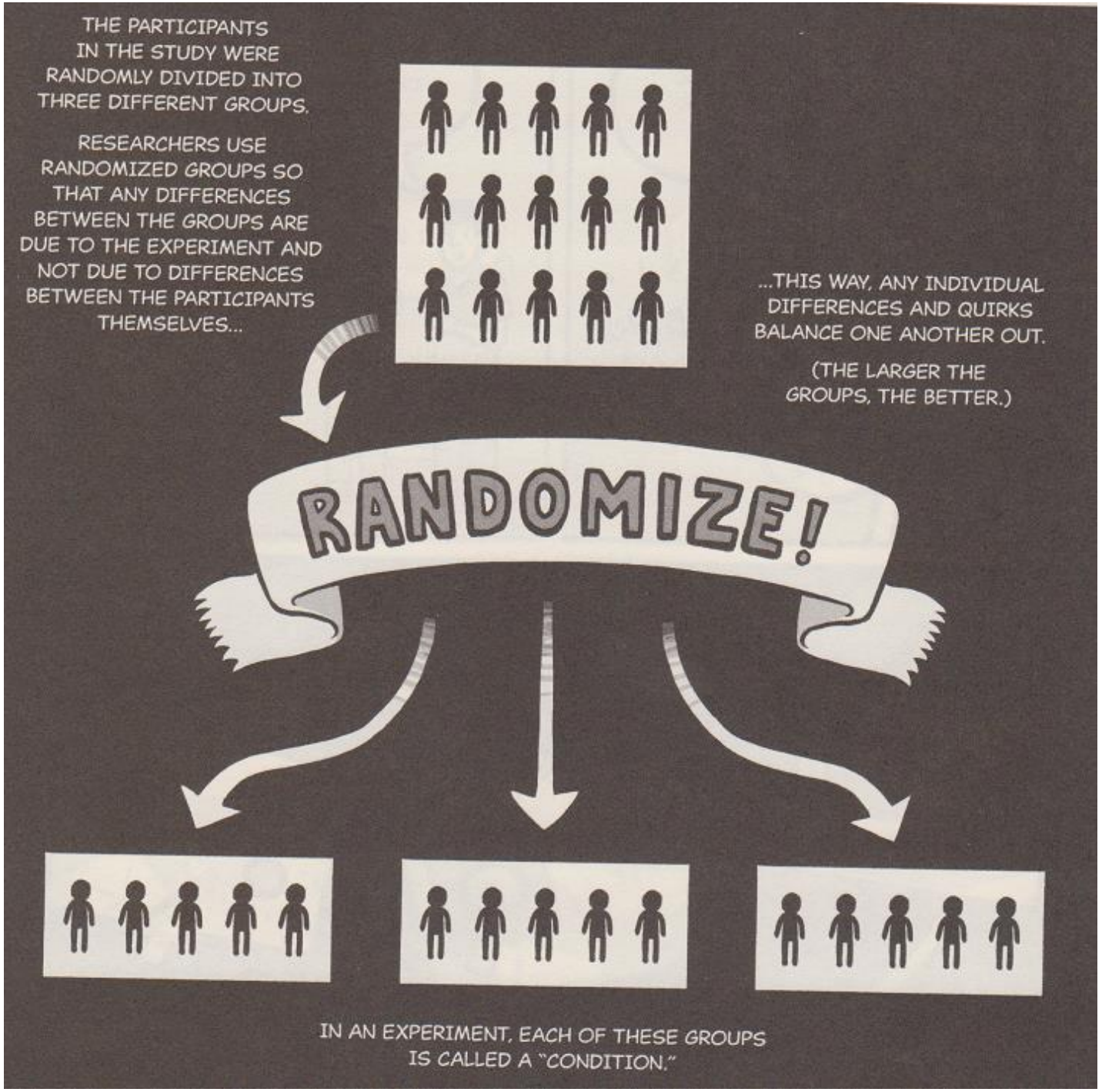
Example of Effective Random Assignment

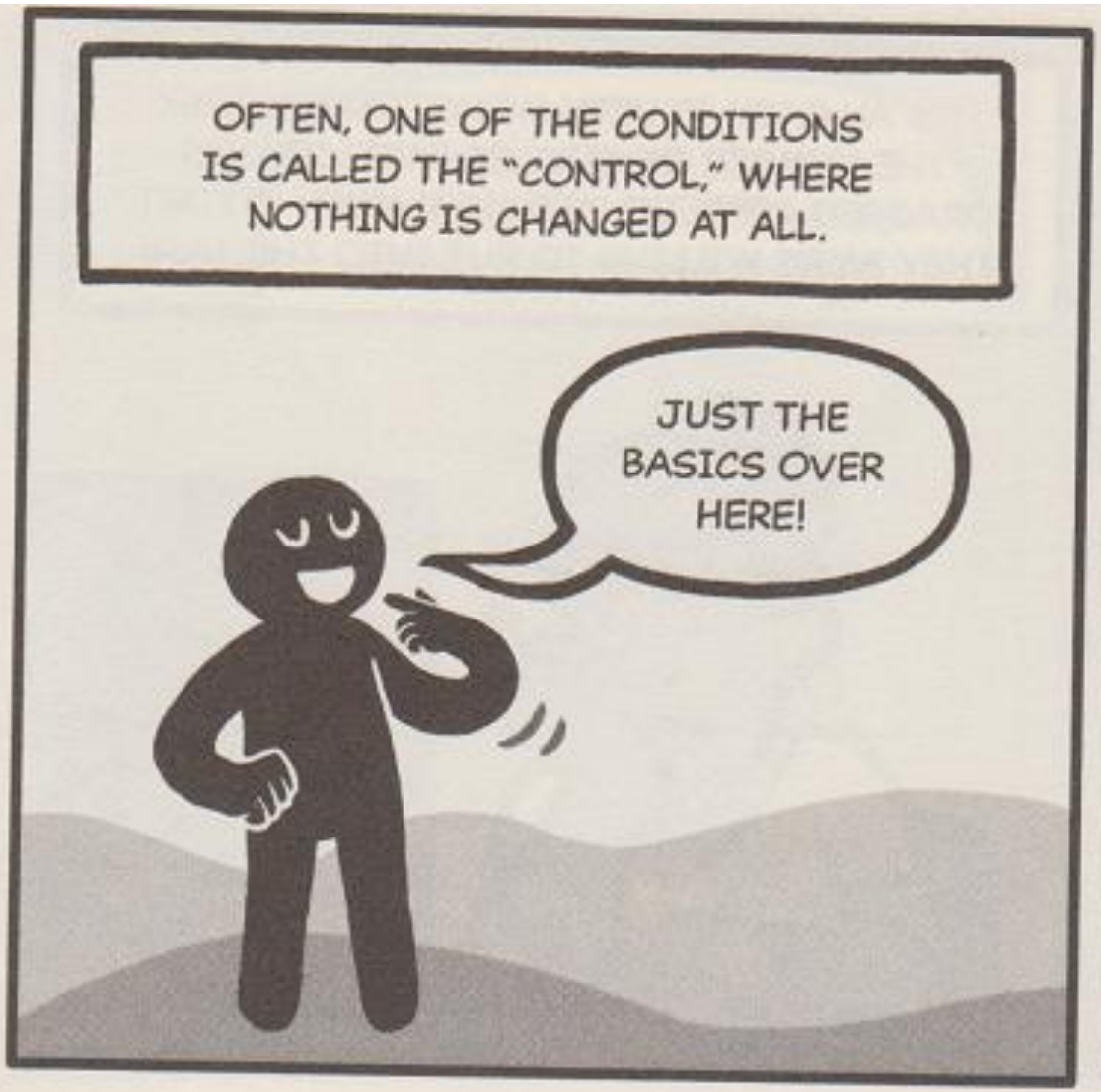
1. Number all pill bottles.
2. (Get a friend to do this) Put in medication or not. Record which numbers have medication and which don't.
3. Get your subject to draw a bottle from the hat. Record which number they used.
4. After all the data is gathered, match up the bottle numbers and find out who had the medication and who didn't.
5. You need a friend to match the bottles with the numbers it so it is "double blinded". The subject doesn't know and you don't either.


BEHAVIORAL ECONOMICS RESEARCHERS JAMES HEYMAN AND DAN ARIELY HAVE EXAMINED OUR SENSITIVITY TO SOCIAL AND MARKET NORMS.
WE ASKED PARTICIPANTS TO DRAG A CIRCLE INTO A BOX ON A COMPUTER SCREEN.

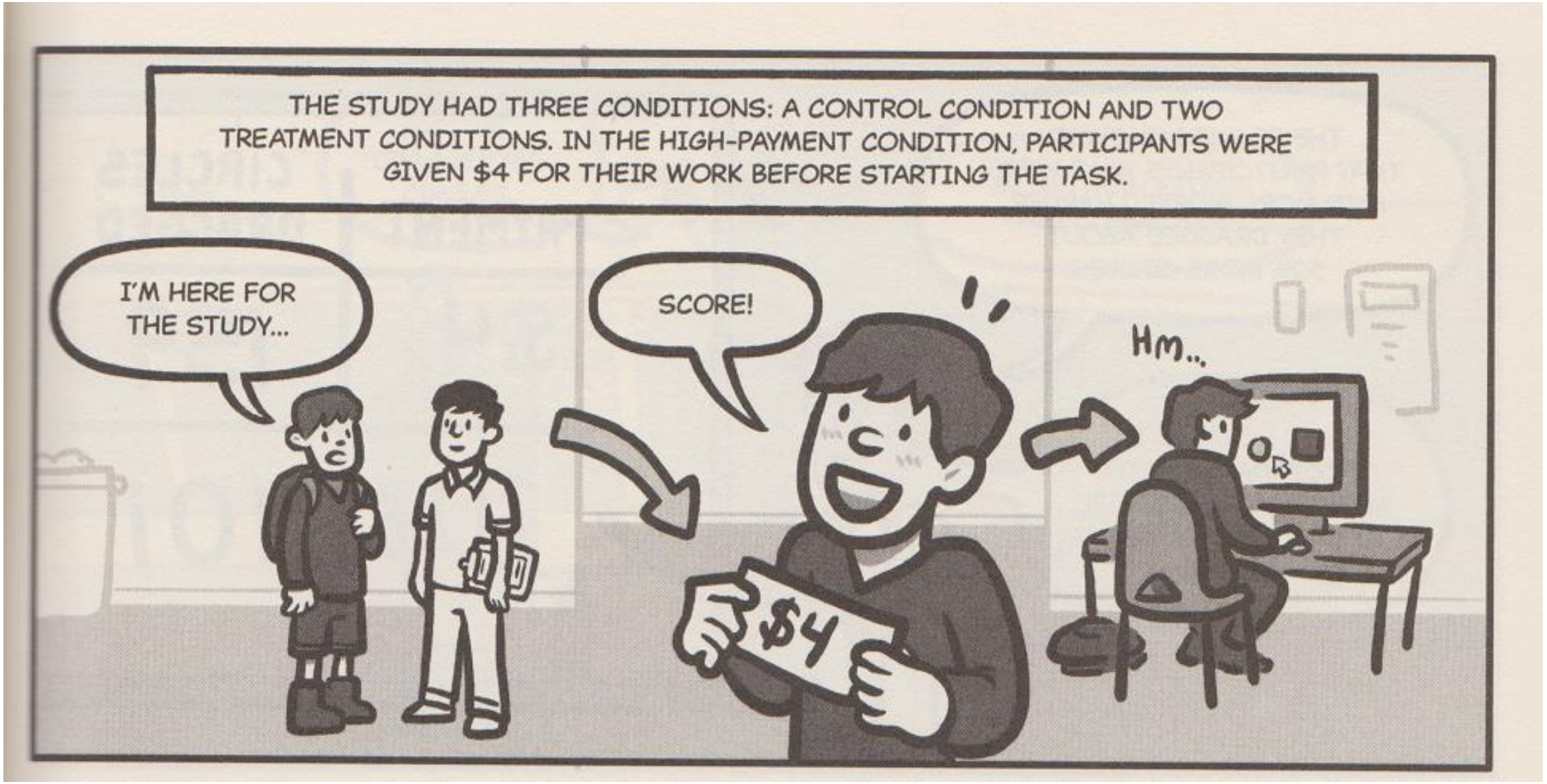

EACH TIME A CIRCLE WAS SUCCESSFULLY DRAGGED INTO THE BOX...
PING!
...A NEW ONE APPEARED!

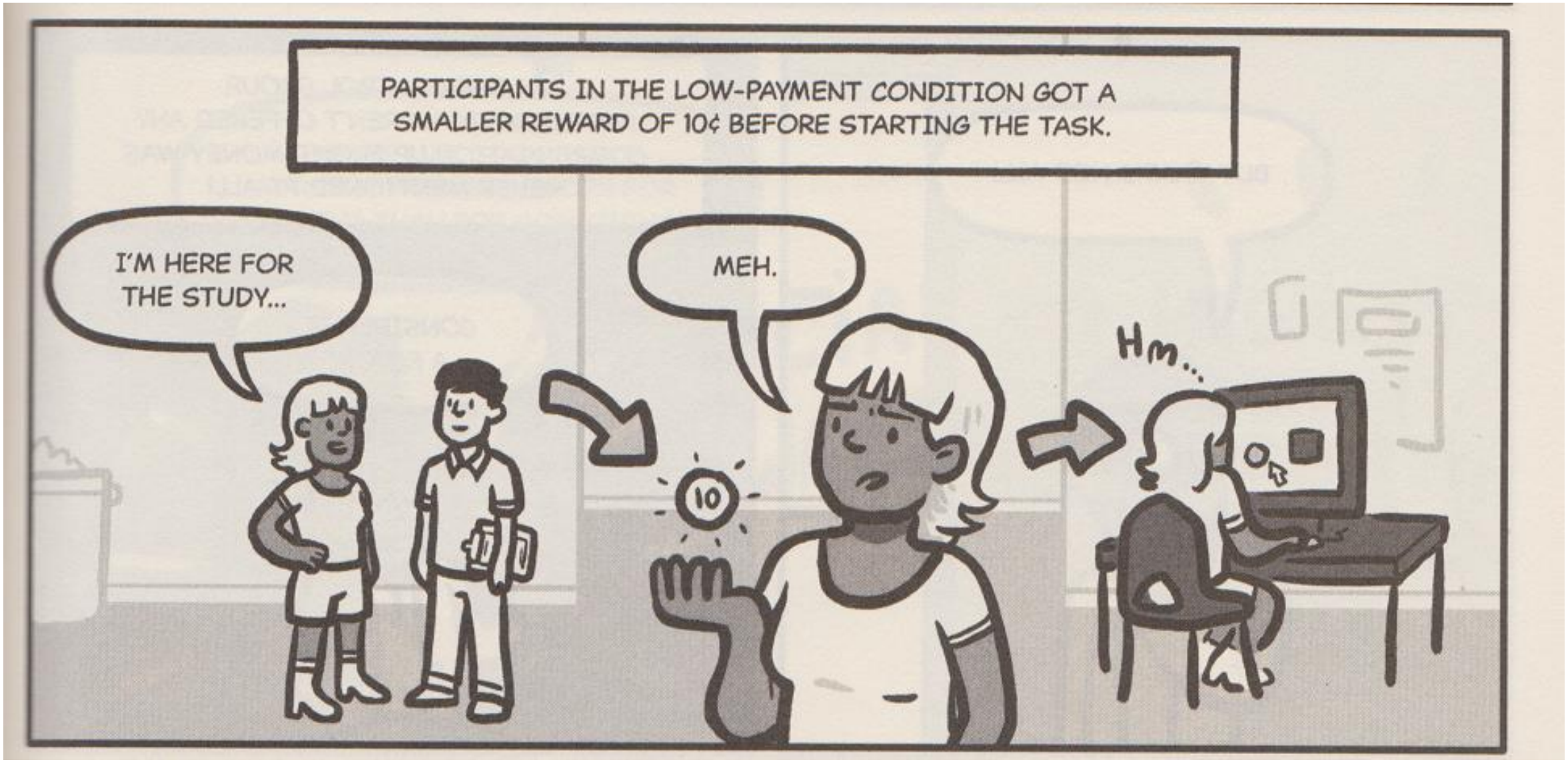

FOR THREE MINUTES, DRAG AS MANY CIRCLES INTO THE BOX AS YOU CAN. ONCE THE TIME IS UP, YOU CAN LEAVE.
3:00
IT'S AN EASY, IF VERY MONOTONOUS TASK. THE NUMBER OF CIRCLES PARTICIPANTS DRAGGED REPRESENTED HOW MUCH EFFORT THEY WERE WILLING TO PUT INTO THE TASK.


THE PARTICIPANTS IN THE STUDY WERE RANDOMLY DIVIDED INTO THREE DIFFERENT GROUPS.
RESEARCHERS USE RANDOMIZED GROUPS SO THAT ANY DIFFERENCES BETWEEN THE GROUPS ARE DUE TO THE EXPERIMENT AND NOT DUE TO DIFFERENCES BETWEEN THE PARTICIPANTS THEMSELVES...
...THIS WAY, ANY INDIVIDUAL DIFFERENCES AND QUIRKS BALANCE ONE ANOTHER OUT.
(THE LARGER THE GROUPS, THE BETTER.)
RANDOMIZE!
IN AN EXPERIMENT, EACH OF THESE GROUPS IS CALLED A "CONDITION."

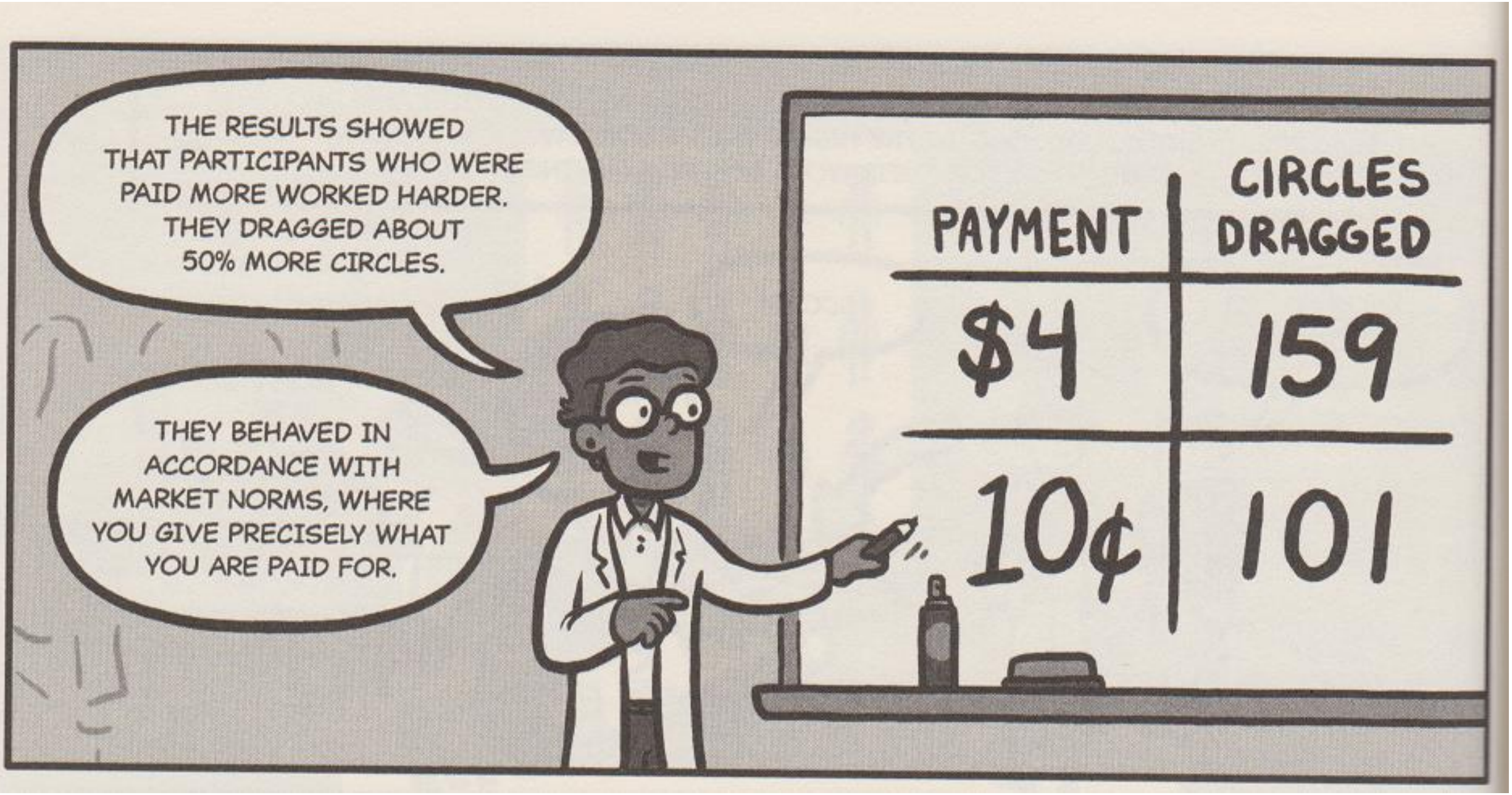

OFTEN, ONE OF THE CONDITIONS IS CALLED THE "CONTROL," WHERE NOTHING IS CHANGED AT ALL.
JUST THE BASICS OVER HERE!

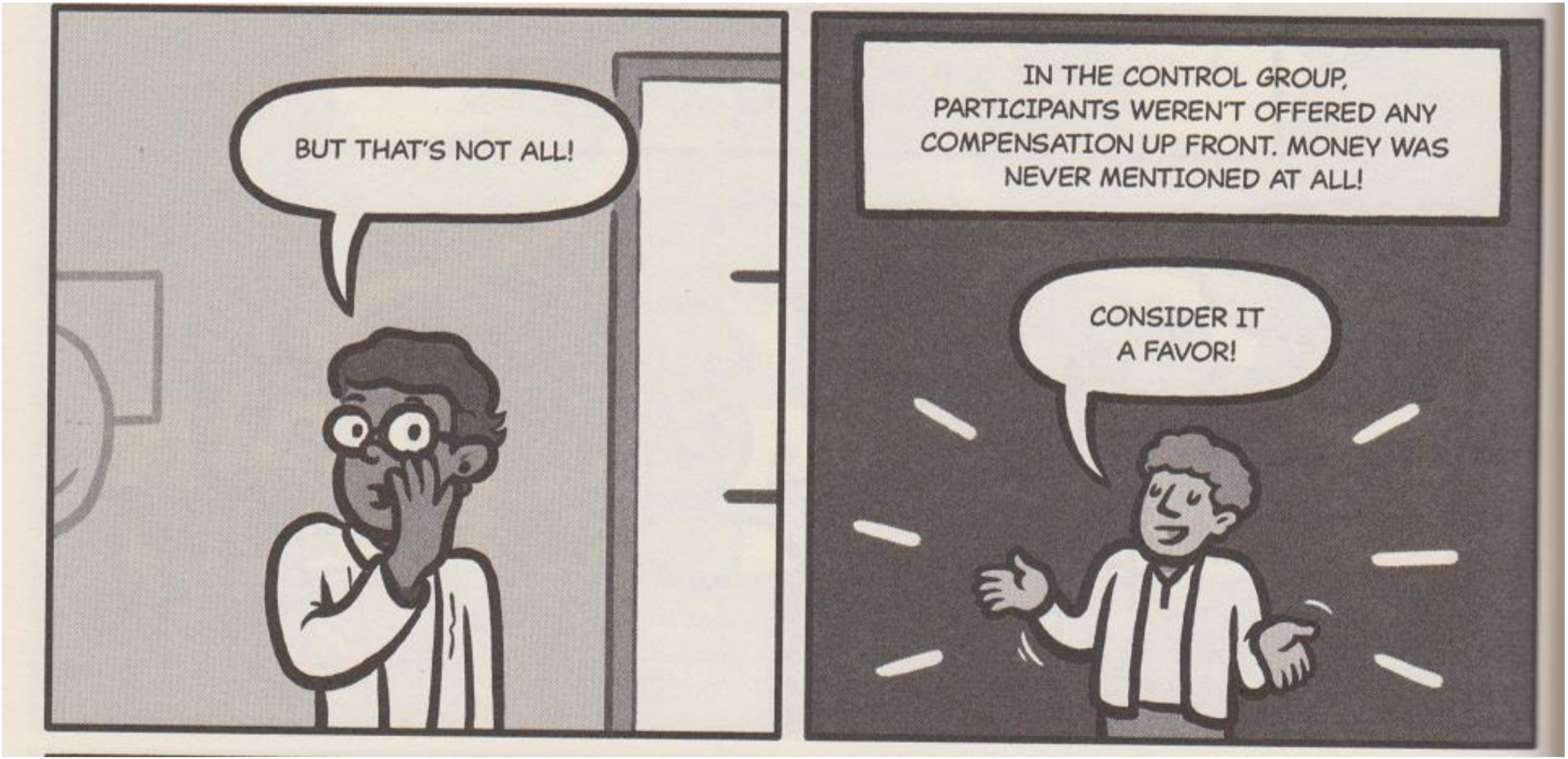
IN THIS STUDY, THE CONDITIONS VARIED BY HOW MUCH PARTICIPANTS WERE REWARDED FOR THEIR TIME.


THE STUDY HAD THREE CONDITIONS: A CONTROL CONDITION AND TWO TREATMENT CONDITIONS. IN THE HIGH-PAYMENT CONDITION, PARTICIPANTS WERE GIVEN $4 FOR THEIR WORK BEFORE STARTING THE TASK.
I'M HERE FOR THE STUDY...
SCORE!
$4
Hm...

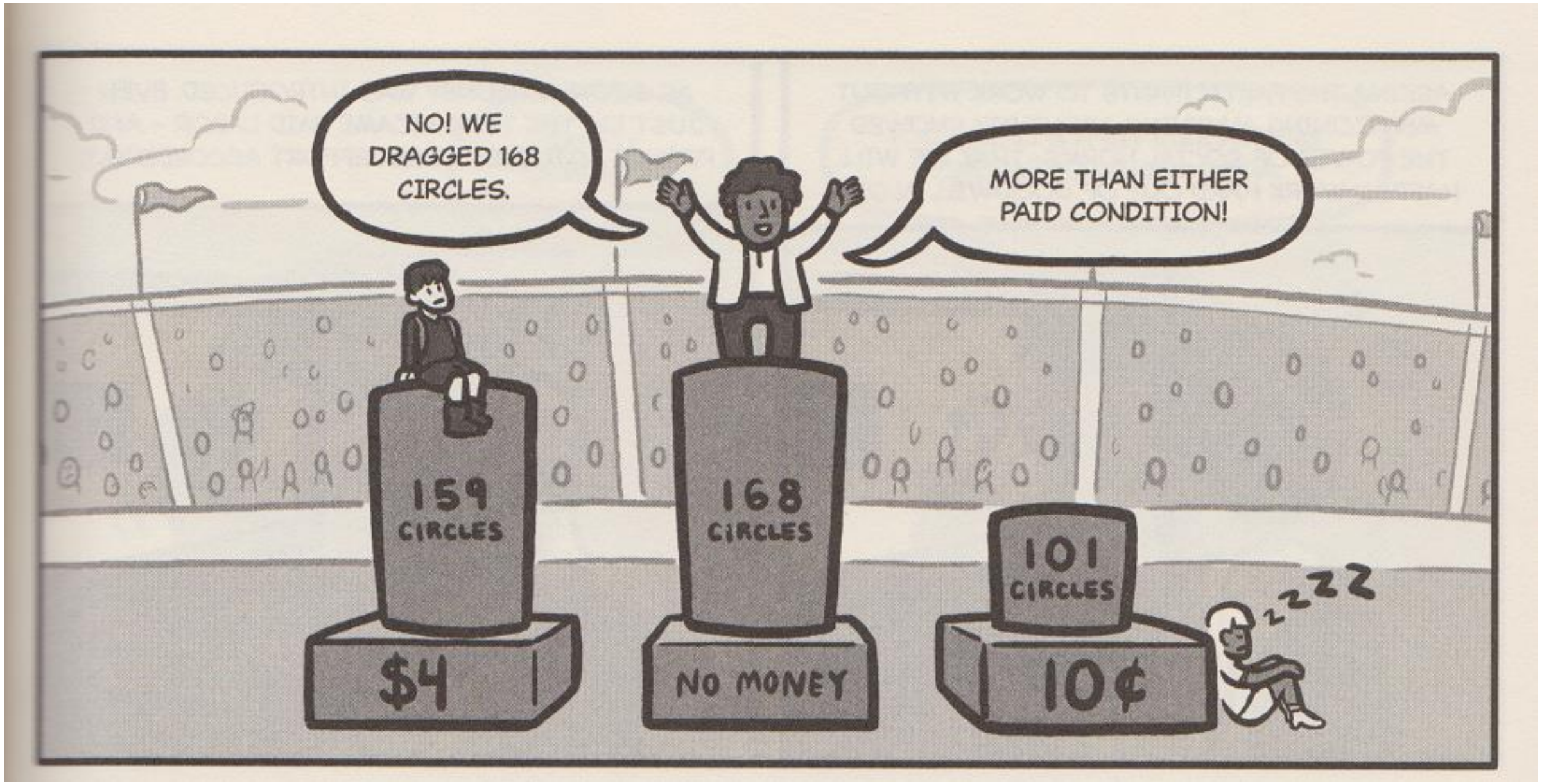

PARTICIPANTS IN THE LOW-PAYMENT CONDITION GOT A SMALLER REWARD OF 10¢ BEFORE STARTING THE TASK.
I'M HERE FOR THE STUDY...
MEH.
10
Hm...

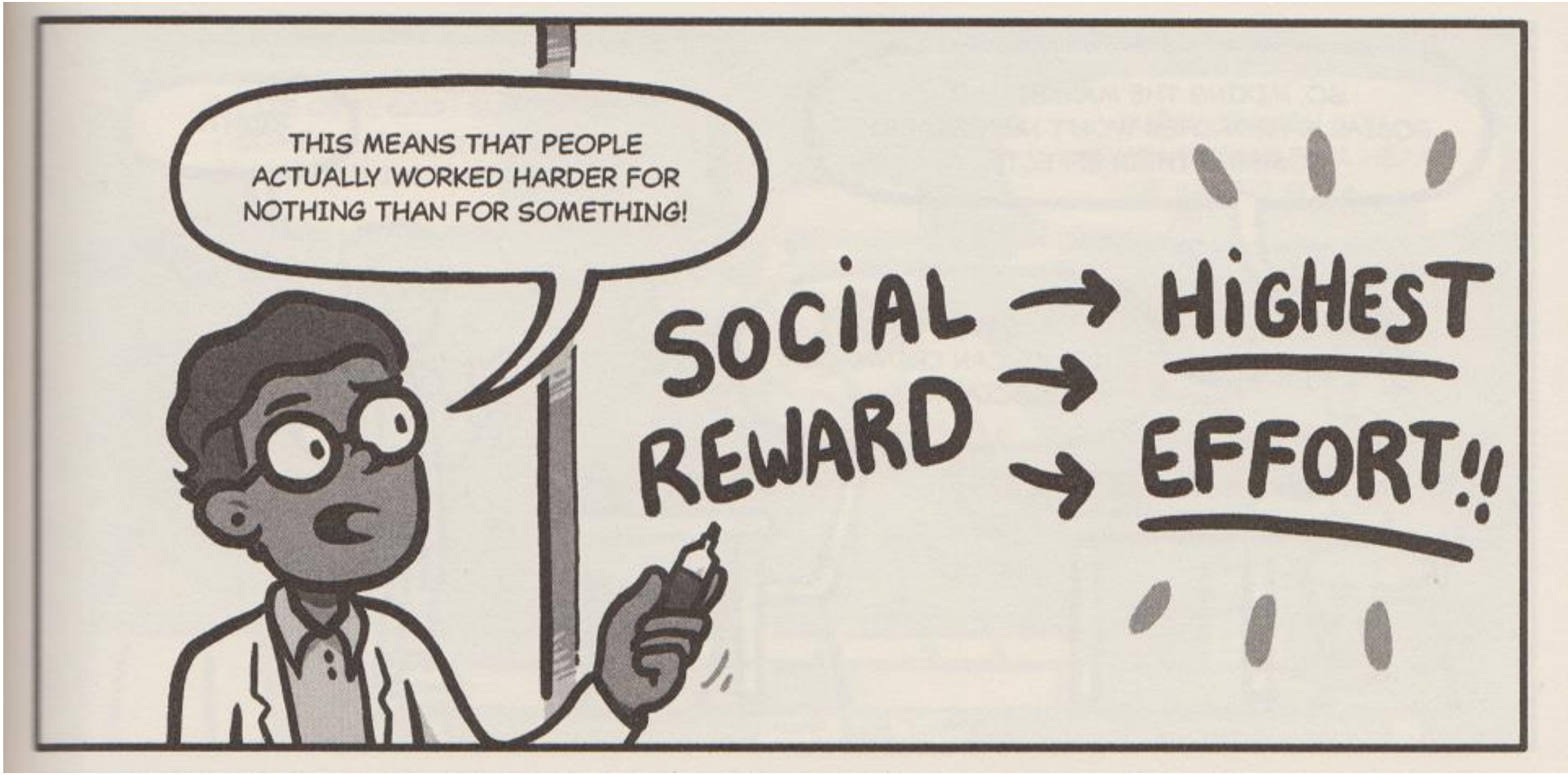
IN MOST EXPERIMENTS, THIS ONE INCLUDED, PARTICIPANTS KNOW ONLY ABOUT THEIR OWN CONDITION – THEY ARE "BLIND" TO THE REST OF THE EXPERIMENT.
SO, NONE OF THE PARTICIPANTS KNEW ANYTHING ABOUT OTHER PARTICIPANTS OR CONDITIONS.

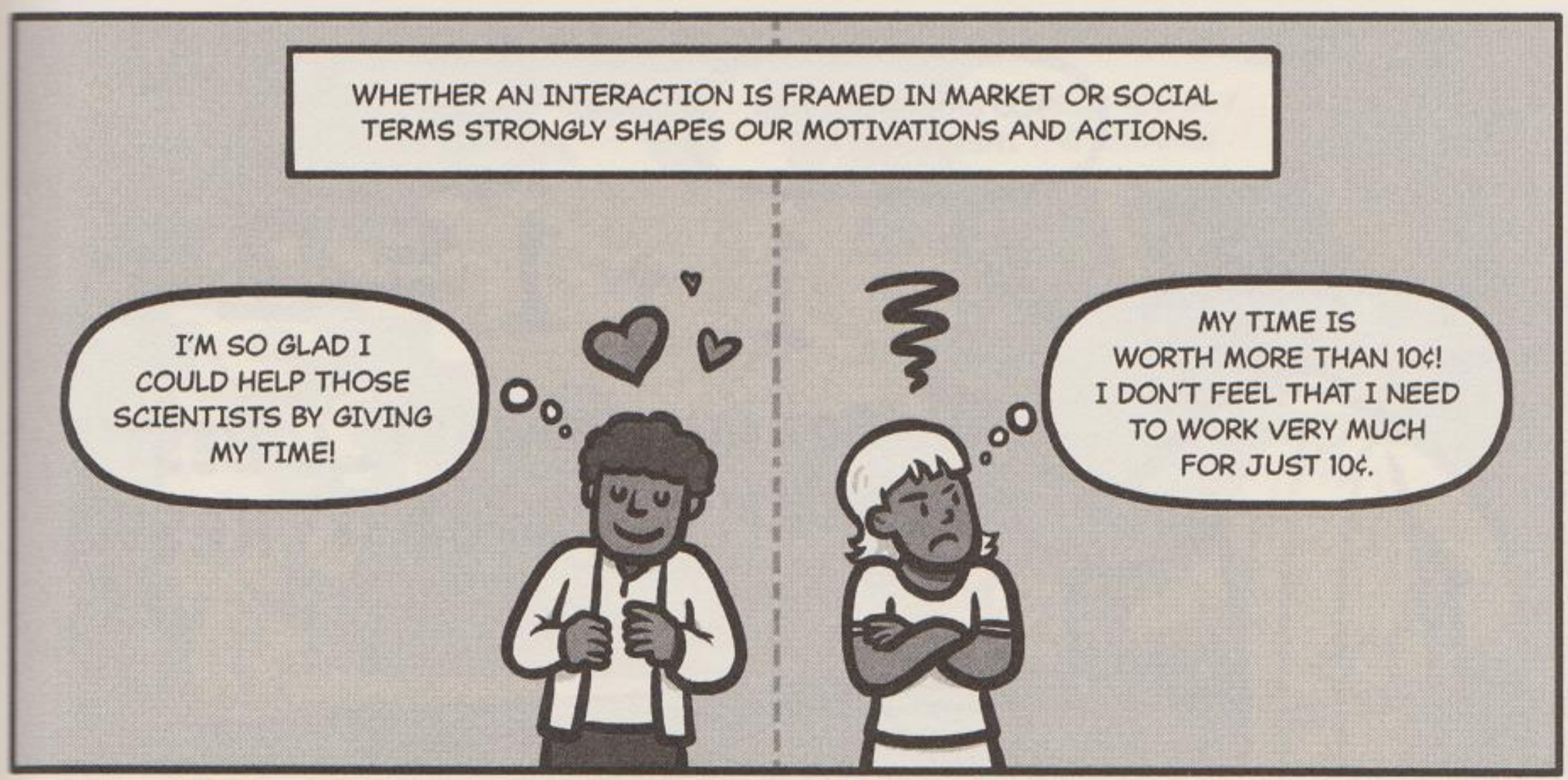

THE RESULTS SHOWED THAT PARTICIPANTS WHO WERE PAID MORE WORKED HARDER. THEY DRAGGED ABOUT 50% MORE CIRCLES.
THEY BEHAVED IN ACCORDANCE WITH MARKET NORMS, WHERE YOU GIVE PRECISELY WHAT YOU ARE PAID FOR.
PAYMENT
CIRCLES DRAGGED
$4
159
10¢
101


BUT THAT'S NOT ALL!
IN THE CONTROL GROUP, PARTICIPANTS WEREN'T OFFERED ANY COMPENSATION UP FRONT. MONEY WAS NEVER MENTIONED AT ALL!
CONSIDER IT A FAVOR!

DID THEY, TOO, APPLY MARKET NORMS?
NO MONEY
NO EFFORT
???


NO! WE DRAGGED 168 CIRCLES.
MORE THAN EITHER PAID CONDITION!
159 CIRCLES
$4
168 CIRCLES
NO MONEY
101 CIRCLES
10¢
zzzz


THIS MEANS THAT PEOPLE ACTUALLY WORKED HARDER FOR NOTHING THAN FOR SOMETHING!
SOCIAL REWARD → HIGHEST → EFFORT!!


WHETHER AN INTERACTION IS FRAMED IN MARKET OR SOCIAL TERMS STRONGLY SHAPES OUR MOTIVATIONS AND ACTIONS.
I'M SO GLAD I COULD HELP THOSE SCIENTISTS BY GIVING MY TIME!
MY TIME IS WORTH MORE THAN 10¢! I DON'T FEEL THAT I NEED TO WORK VERY MUCH FOR JUST 10¢.

ASKING THE PARTICIPANTS TO WORK WITHOUT MENTIONING ANYTHING ABOUT PAY SHOWED THE POWER OF SOCIAL NORMS: THAT WE WILL HAPPILY WORK HARD OUT OF GOODWILL ALONE.

AS SOON AS MONEY WAS INTRODUCED, EVEN JUST 10¢, THE TASK BECAME PAID LABOR – AND PEOPLE ADJUSTED THEIR EFFORT ACCORDINGLY.

1. Causal/Descriptive?

1. Causal/Descriptive? – Causal
2. Research Question

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2. Research Question – Does payment increase motivation?
3. Problem Unit

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4. Plan Unit –

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3. Problem Unit – a person
4. Plan Unit – a person in Ariely and Heyman's study from the university's study group.
5. Replication –

1. Causal/Descriptive? – Causal
2. Research Question – Does payment increase motivation?
3. Problem Unit – a person
4. Plan Unit – a person in Ariely and Heyman's study from the university's study group.
5. Replication – unknown
6. Sampling Technique –

1. Causal/Descriptive? – Causal
2. Research Question – Does payment increase motivation?
3. Problem Unit – a person
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5. Replication – unknown
6. Sampling Technique – random from the university's list
7. Diversity Limitations –

1. Causal/Descriptive? – Causal
2. Research Question – Does payment increase motivation?
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5. Replication – unknown
6. Sampling Technique – random from the university's list
7. Diversity Limitations – had to be on university's list, probably university students, in early 20s.
8. Random Assignment –

1. Causal/Descriptive? – Causal
2. Research Question – Does payment increase motivation?
3. Problem Unit – a person
4. Plan Unit – a person in Ariely and Heyman's study from the university's study group.
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6. Sampling Technique – random from the university's list
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8. Random Assignment – to 3 groups: payments of $4, $0.05, none
9. Variable –

1. Causal/Descriptive? – Causal
2. Research Question – Does payment increase motivation?
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8. Random Assignment – to 3 groups: payments of $4, $0.05, none
9. Variable – (1) payment, (2) number of circles dragged in 3 minutes
10. Calculation –

1. Causal/Descriptive? – Causal
2. Research Question – Does payment increase motivation?
3. Problem Unit – a person
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7. Diversity Limitations – had to be on university's list, probably university students, in early 20s.
8. Random Assignment – to 3 groups: payments of $4, $0.05, none
9. Variable – (1) payment, (2) number of circles dragged in 3 minutes
10. Calculation – average number of circles dragged in each group.

One day some papers catch fire in a wastebasket in the Dean’s office. Luckily, a physicist, a chemist, and a statistician happen to be nearby. Naturally, they rush in to help. The physicist whips out a notebook and starts to work on how much energy would have to be removed from the fire in order to stop the combustion. The chemist works on determining which reagent would have to be added to the fire to prevent oxidation.

While they are doing this, the statistician is setting fires to all the other wastebaskets in the adjacent offices. "What are you doing?" the Dean demands.

To which the statistician replies, "To solve a problem of this magnitude, you need a large sample size."

Understand why each isn’t random, then fix it.

Stand at subway entrance at Union Station at 7:00 am.

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Randomized – put times and locations (not all subways) in a hat. Draw them out. Go to a few locations.

Go to the cafeteria period 2. Ask whoever is there your question.

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Randomized - Put rooms, hallways, cafeterias and times in a computer. Get it to randomly select a few locations and times.

Ask whoever answers the phone.

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Randomized: ask to speak to whoever’s birthday is closest?

On-line surveys (same problem)

On-line surveys (same problem)

Randomized: Need a bank of email/house addresses. Get a computer to randomly select the people. Email or mail those people. Bug them to get them to respond.

Walk into forest and randomly select tree.

Walk into forest and randomly select tree.

Get a map of the forest. Blindfold yourself. Throw a dart. Go to that location, sample the tree closest to it.