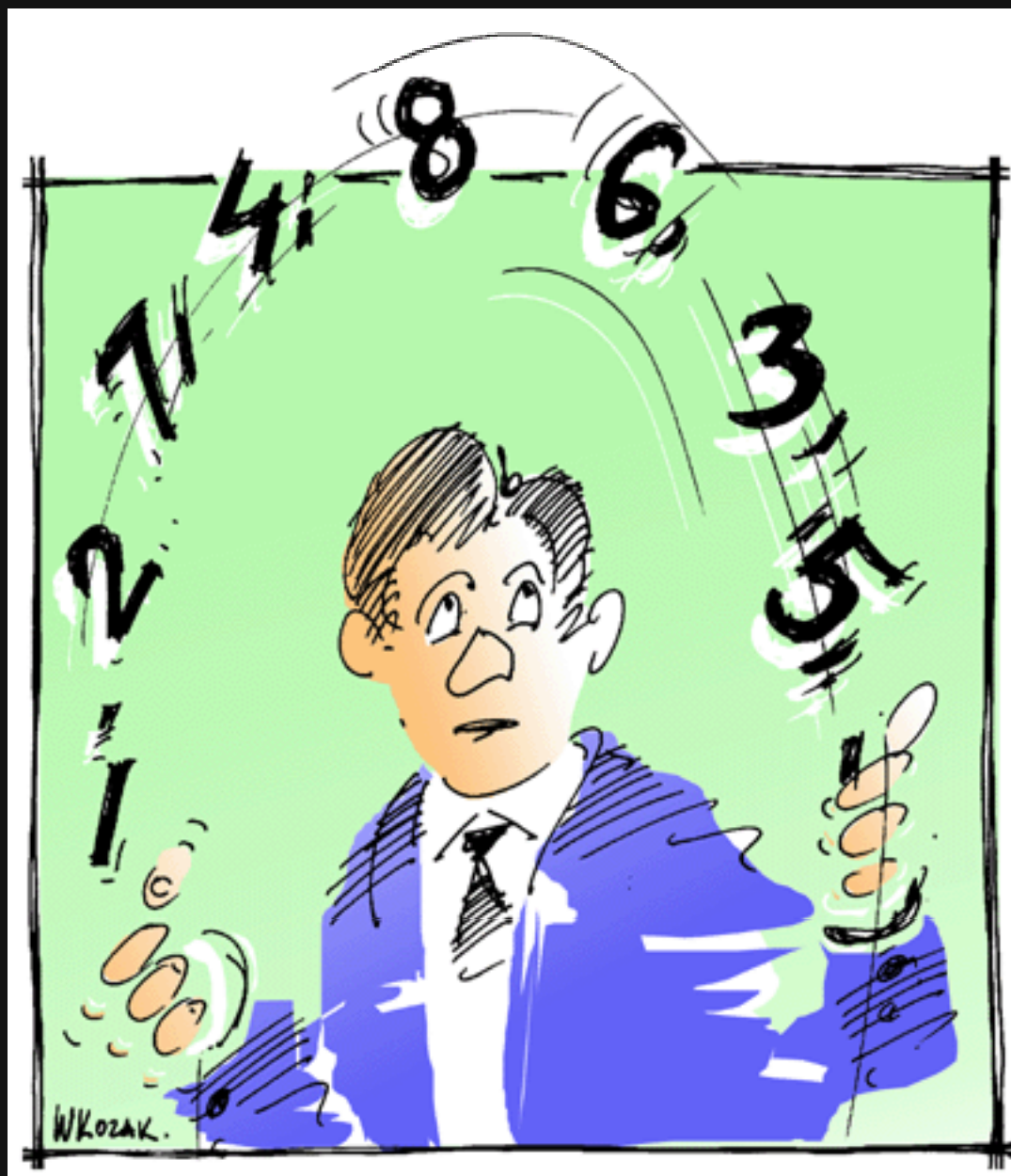# STATISTICS

What is Statistics?

- An essential and very useful tool in science

- Learning from the data we have

- Generalizing from what we *know and can measure* to what we *do not know and cannot measure directly*

How do I do STATS?

- You need to learn:
    - *why* each statistical procedure is used
    - *when* to use each statistical procedure
    - *how* to interpret its results.

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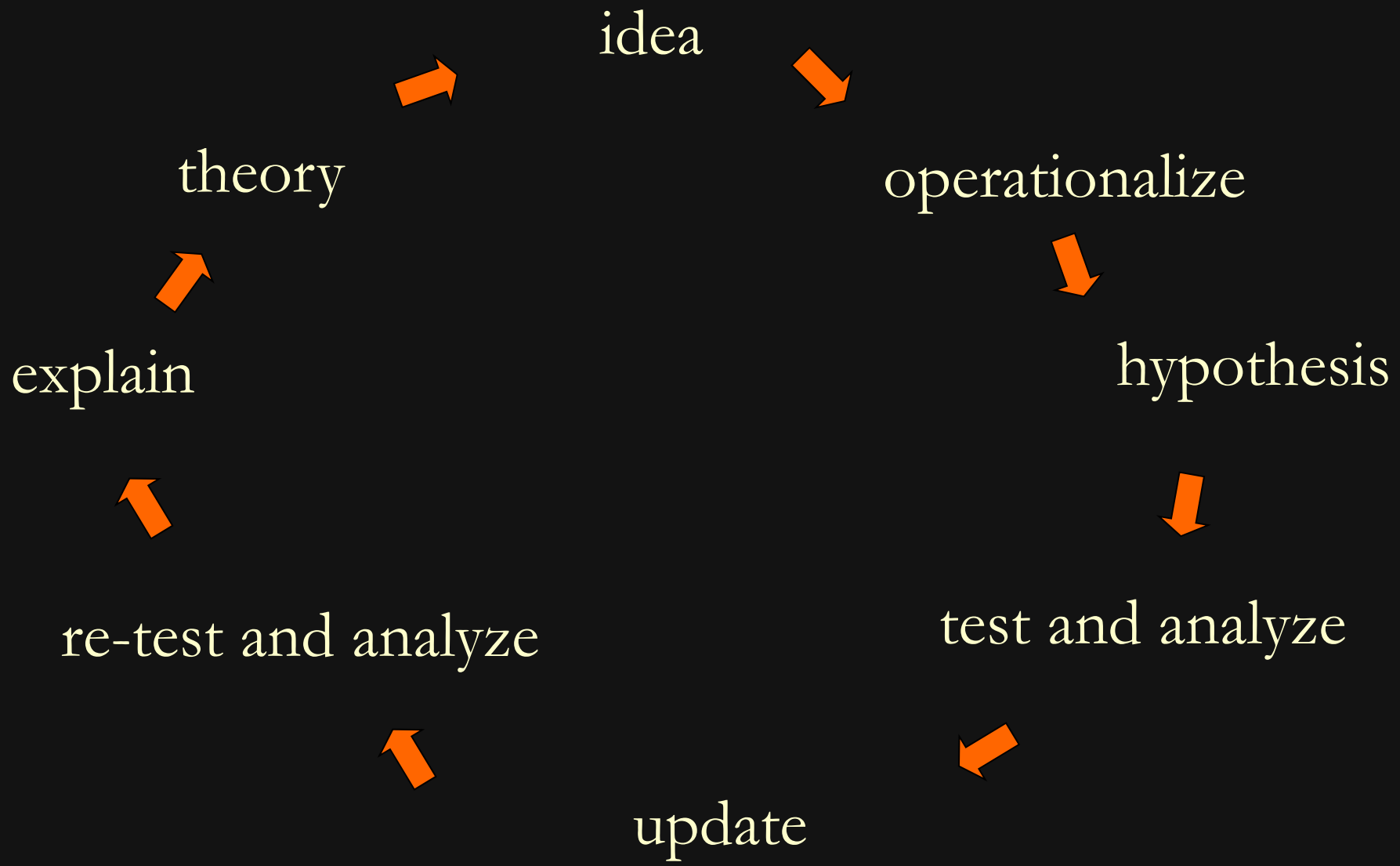
Statistics in Real Life

- Actually, you already know some STATS.

- How?
    - Making decisions
    - Forming stereotypes
    - Persuading someone to do something

Can we do without?

- Not really,
    - Science would be impossible

    - It would be harder to make sense of the world around us

THE RESEARCH PROCESS

idea

operationalize

hypothesis

test and analyze

update

re-test and analyze

explain

theory

Samples and Populations

- *Population:* The entire group of people that you are interested in studying.

- *Sample:* A subset of the population that represents it well.

Statistics and Parameters

- A *statistic* is a number that describes a characteristic of a sample of scores

  - Latin alphabet

- A *parameter* is a number that describes a characteristic of a population of scores

  - Greek alphabet

Inferences

We use the scores in a sample to *infer* or to estimate the scores we would expect to find in the population.

Obtaining Data

- A *variable* is anything that, when measured, can produce two or more different values. Some common variables are:

  – Age

  – Gender

  – Intelligence

  – Personality type

Relationships

A *relationship* occurs when a change in one variable is accompanied by a consistent change in another variable.
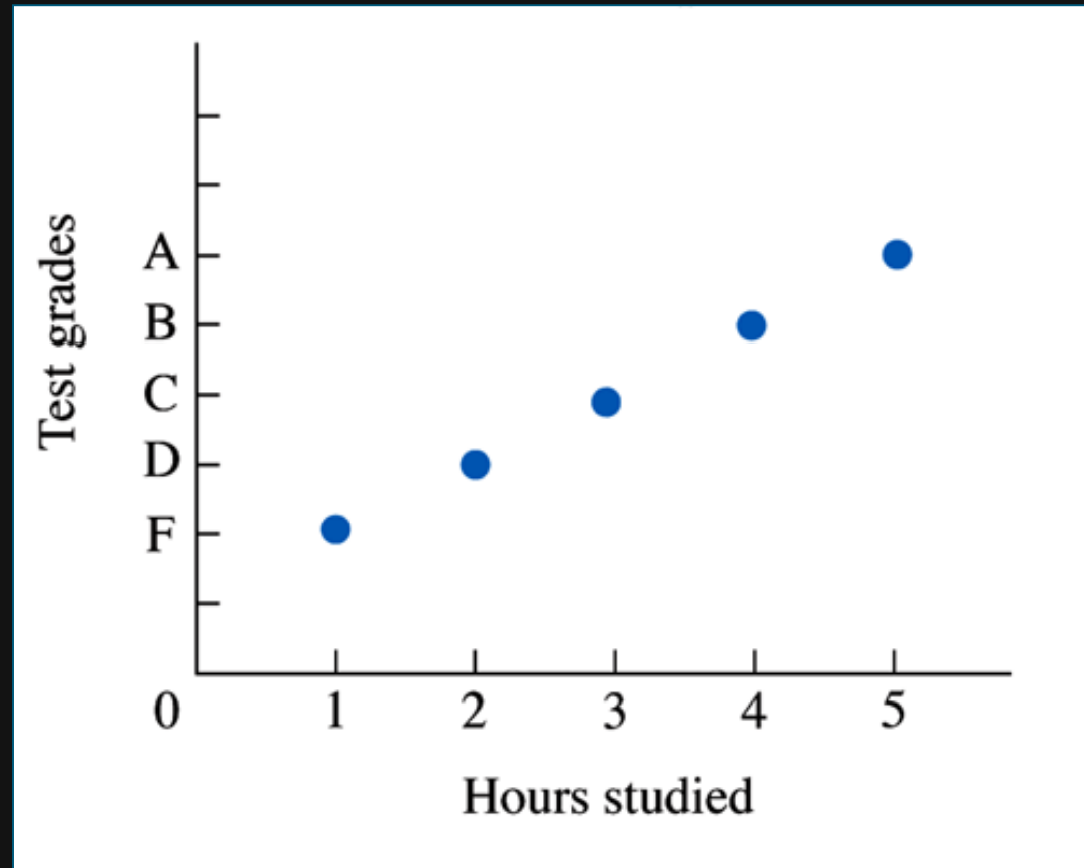
Graphing Relationships

- Describe a relationship using the general format:
    - "Scores on the Y variable change as a function of changes in the X variable."
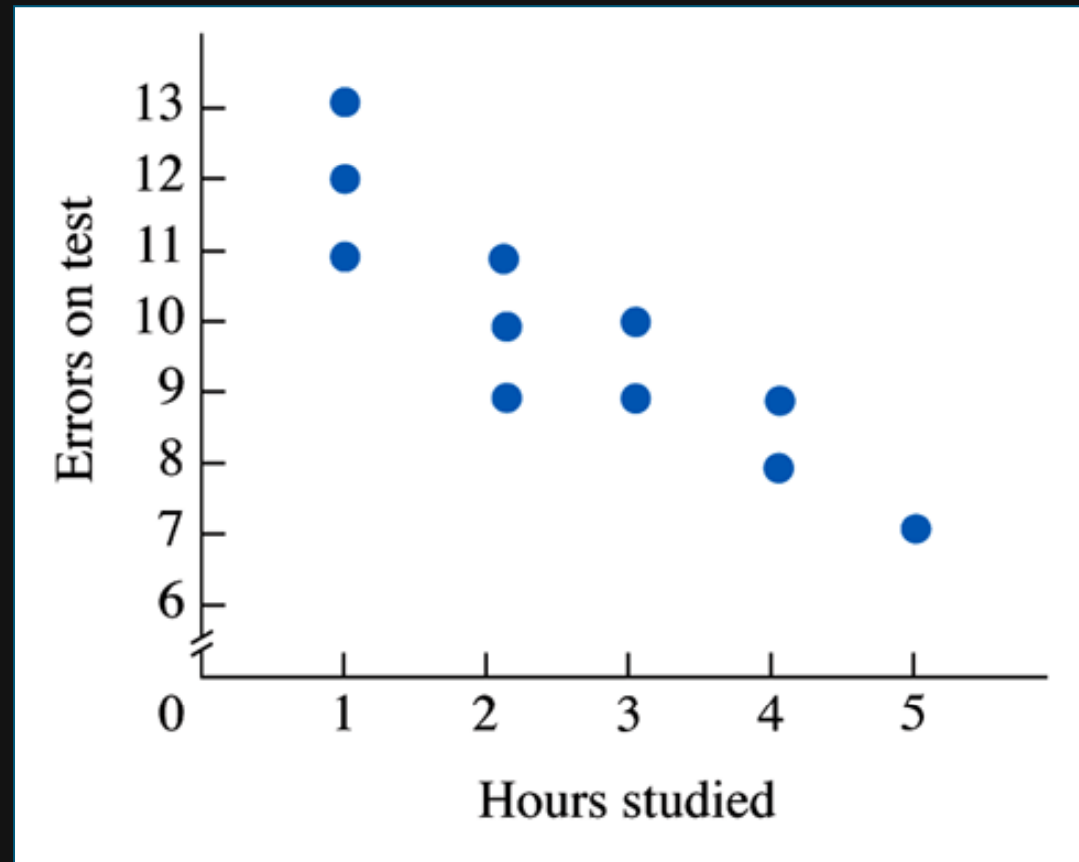   - The given variable in a study is the X variable.
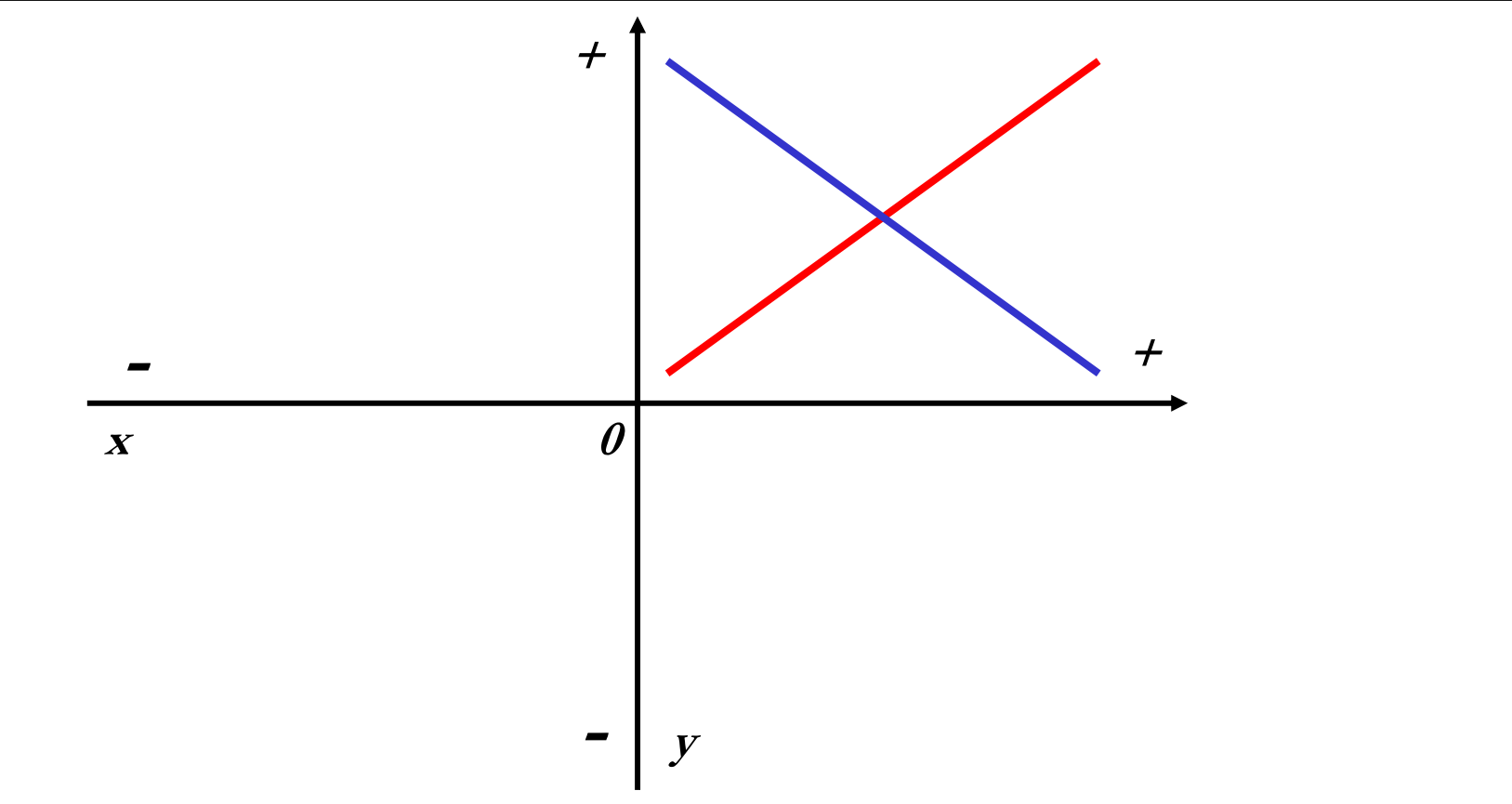
Graphing Relationships

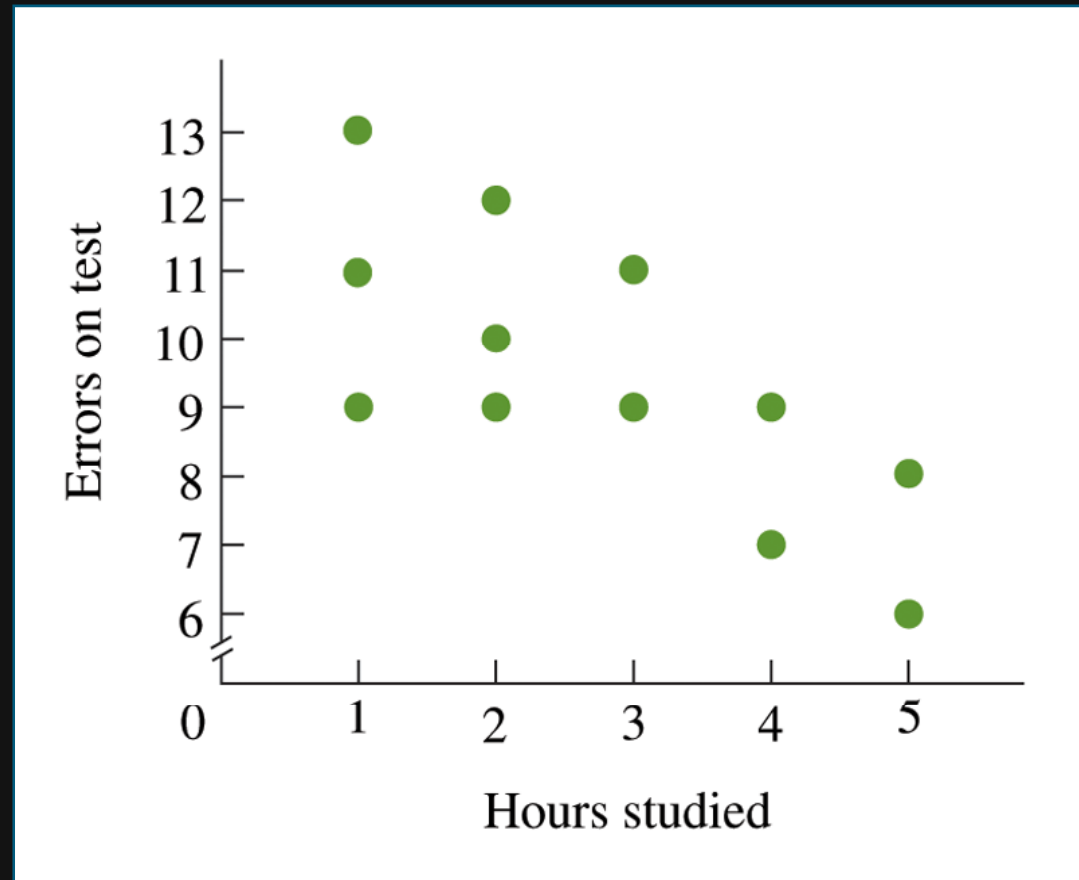A graph showing a perfectly consistent association.

Graphing Relationships

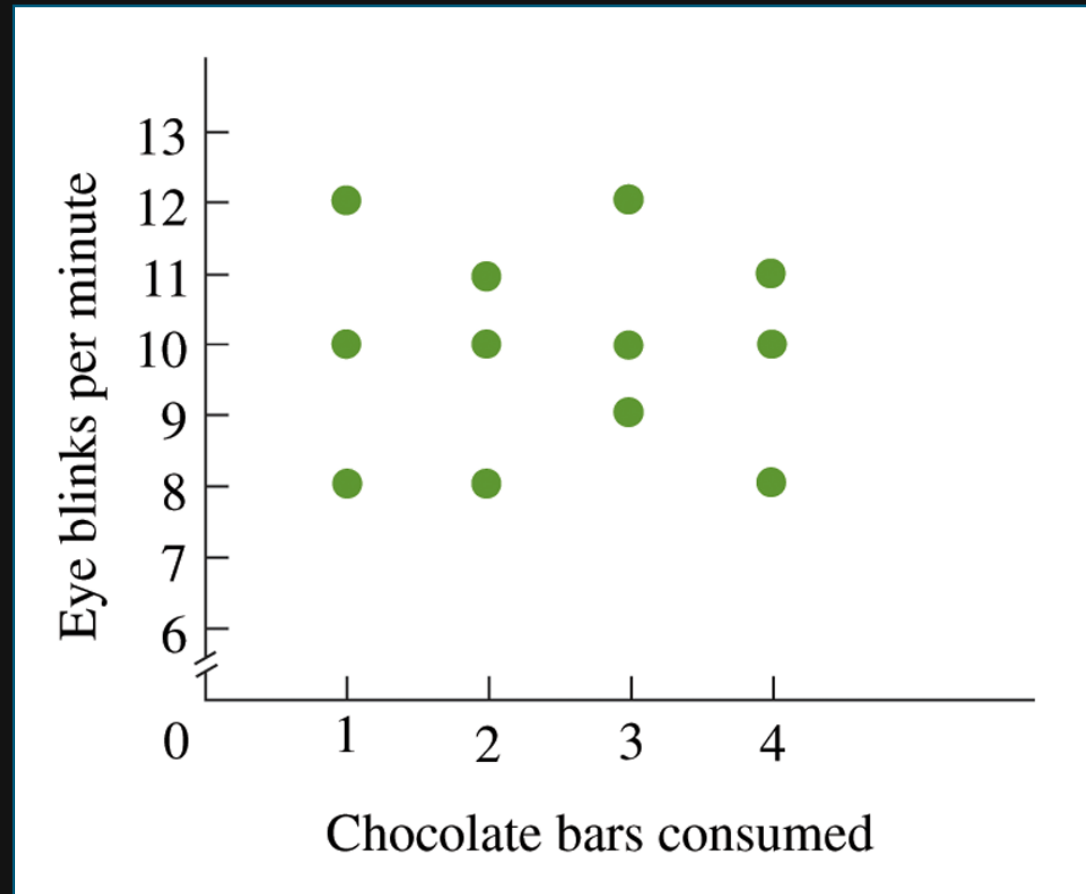A relationship that is not perfectly consistent.

Graphing Relationships

A weak relationship.

Graphing Relationships

No consistent pattern.

Descriptive and Inferential Statistics

Descriptive Statistics

- Procedures used for organizing and summarizing data.

  – What scores occurred?

  – What's the average or typical score?

  – Are the scores very similar to each other or very different and spread out?

Inferential Statistics

- Procedures for deciding whether sample data accurately represent a particular relationship in the population

- Allow us to make *inferences* about the score and relationship found in the population

Experiments and Correlational Studies

Experiments

The researcher actively changes or *manipulates* one variable and then measures participants' scores on another variable to see if a relationship is produced

The Independent Variable

- The variable that is *changed* or manipulated by the experimenter.

- *Condition or level:* specific amount or category of the independent variable.

The Dependent Variable

The variable that is *measured* under each condition/level of the independent variable.

Correlational Studies

- We simply measure participants' scores on two variables and then determine whether a relationship is present

- No causality

CORRELATION IS NOT CAUSATION

Causality

We cannot definitively prove that the independent variable causes the scores on the dependent variable to change. It is always possible that some other hidden variable is actually the cause.

The Characteristics
of the Scores

Measurement Scales

– A *nominal scale* does not indicate an amount; rather, it is used for identification, as a name.

– An *ordinal scale* indicates rank order. There is not an equal unit of measurement separating each score.

Measurement Scales (cont'd)

- An *interval scale* indicates an actual quantity and there is an equal unit of measurement separating adjacent scores. Interval scales do not have a "true" 0.

- A *ratio scale* reflects the true amount of the variable that is present because the scores measure an actual amount, there is an equal unit of measurement, and 0 truly means that zero amount of the variable is present.

Summary of Measurement Scales

	Type of Measurement Scale			
	Nominal	**Ordinal**	**Interval**	**Ratio**
What Does the Scale Indicate?	Quality	Relative quantity	Quantity	Quantity
Is There an Equal Unit of Measurement?	No	No	Yes	Yes
Is There a True Zero?	No	No	No	Yes
How Might the Scale be Used in Research?	To identify males and females as 1 and 2	To judge who is 1st, 2nd, etc., in aggressiveness	To convey the results of intelligence and personality tests	To count the number of correct answers on a test
Additional Examples	Telephone numbers Social Security numbers	Letter grades Elementary school grade	Checkbook balance Individual's standing relative to class average	Weight Distance traveled