# Overview of the Scientific Method

Reading: pp. 23-56

# Scientific research

- The scientific process begins with observing phenomenon in the real world.
- General inquiries can be refined into research questions.
- Once your RQ is finalized, you begin the process outlined in the figure

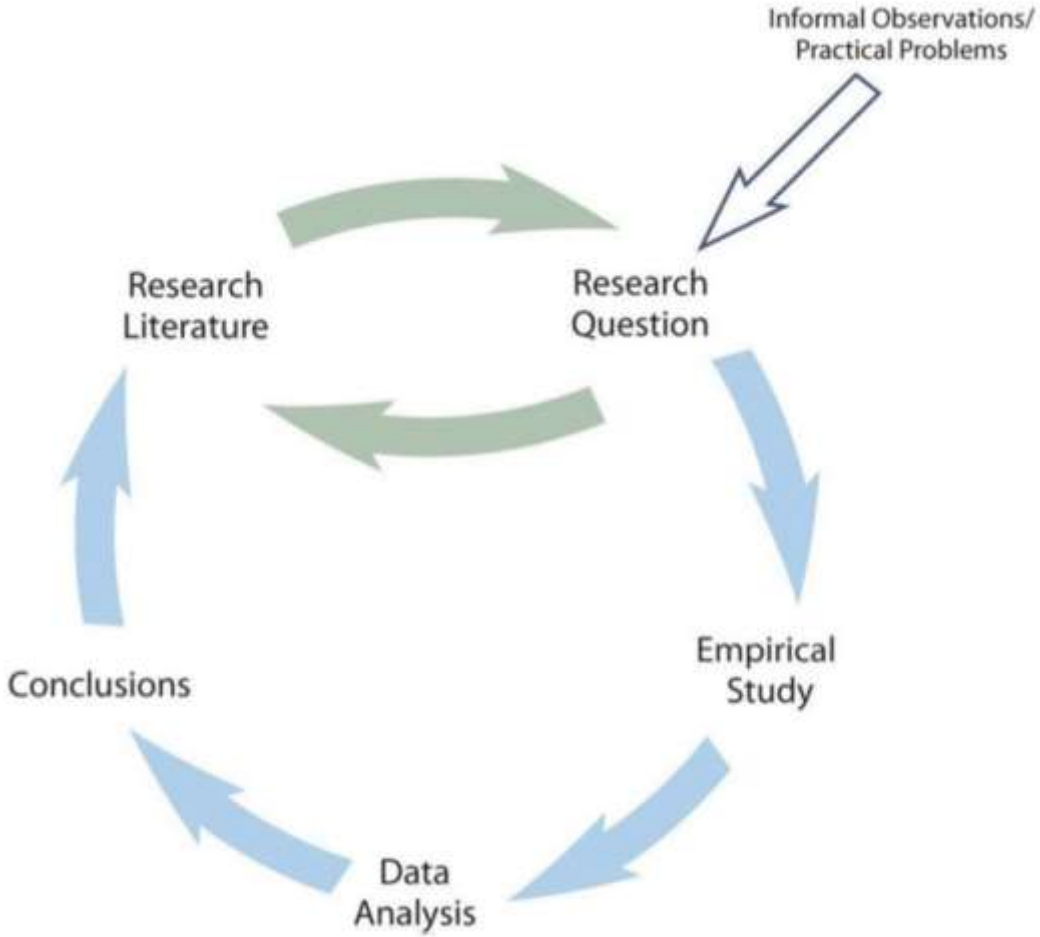
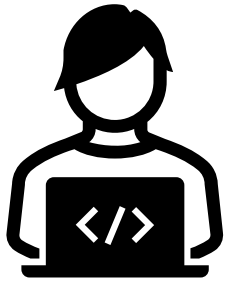



*Figure 2.1 A Simple Model of Scientific Research in Psychology*

# Identifying a research topic



- Which human behaviors interest you?
  - Dating, aggression, social attitudes, perception, religious practices…
- Questions can arise from informal observations, practical problems and pre-existing research
- Look for **peer-reviewed** professional journals that have a double-blind review process, as well as scholarly works and edited volumes
  - Empirical reports, review articles, theoretical pieces, meta-analyses
  - Peer-reviewed sources are typically the ‘best’ resources

# Searching for relevant literature

- Learning how to review research literature is of paramount importance
  - Running a redundant or poorly-controlled study is a waste of everyone's resources
  - Peer-reviewed sources may not necessarily agree with one another, and that's ok! Conflict generates progress whereas conformity maintains stagnation.
- Where do we find relevant literature? (*Not* news or social media sites)
  - PsychINFO
  - Google Scholar

# Generating good research questions

- Can the question be empirically tested? Are **you** interested in the topic?
- Questions to encourage further thought…
  - What are some possible **causes** and **effects** of the behavior or characteristic?
  - What types of **people** and **situations** are associated with more or less of a particular behavior or characteristic?
- Addressing these queries will help refine future research questions

# Developing hypotheses

- A **theory** attempts to provide an explanation of a range of phenomena and, within science, is typically backed up by numerous confirmed hypotheses.
- A **hypothesis** is a *specific* prediction about a phenomenon generated from a particular theory (though not always). Hypotheses may be **confirmatory** (if X then Y) or **exploratory** (what happens when X?)
- Features of good hypotheses: Falsifiability, logical soundness; positive prediction

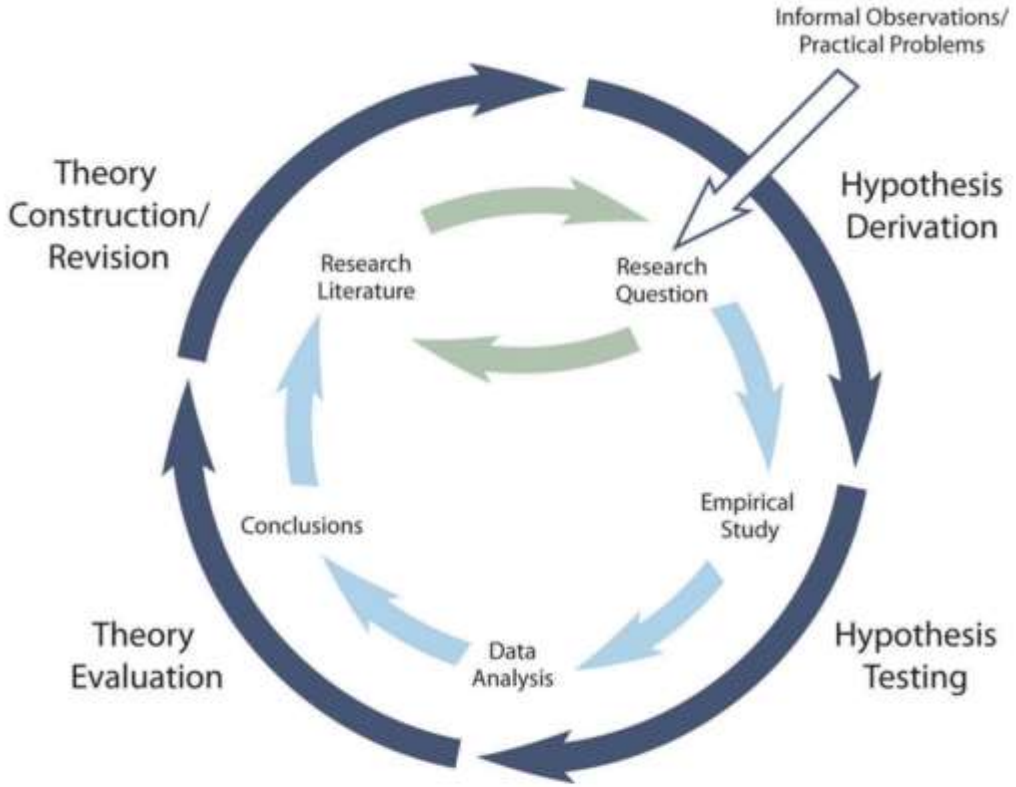
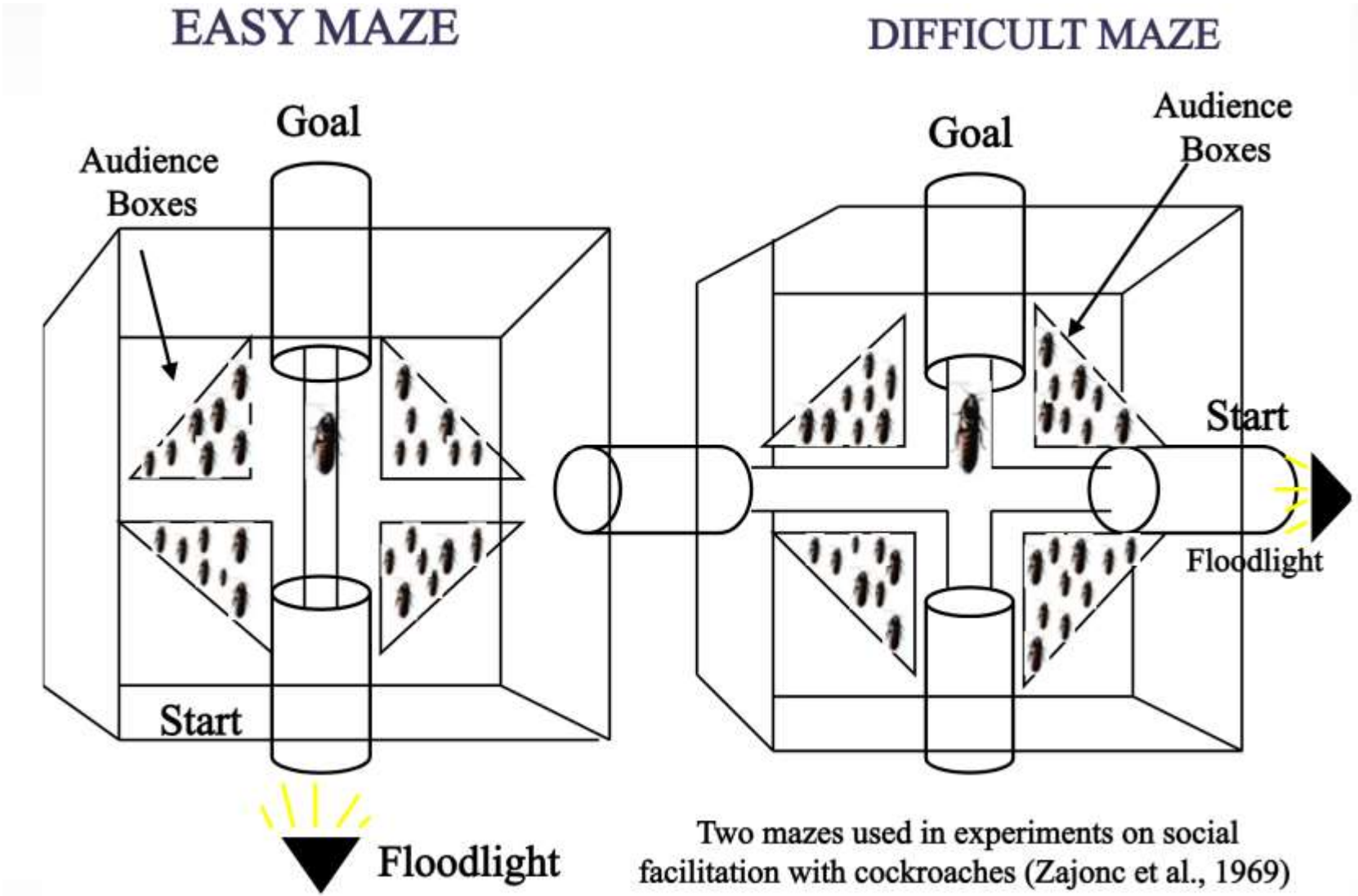



*Figure 2.2 Hypothetico-Deductive Method Combined With the General Model of Scientific Research in Psychology Together they form a model of theoretically motivated research.*




Two mazes used in experiments on social facilitation with cockroaches (Zajonc et al., 1969)

Source: Slideplayer

# Designing a study

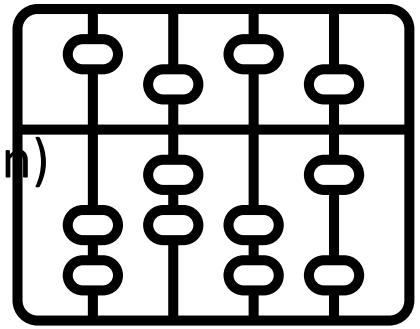
- Identify your **variables** (a quantity/quality that varies)
  - Height , scores ~ quantitative| Study major, religion ~ qualitative
- Generate an **operational definition** to specify how a variable is to be measured
- Identify your **sample** and the strategy for their **recruitment**
  - Simple random sampling (every member of a population has an equal chance of being sampled)
  - Convenience sampling (whoever is nearby/accessible – typically more ‘convenient’ for the researcher but at the loss of population representability)

# Designs contd.

- Experimental research
  - Manipulate the independent variable (diet); measure the dependent variable (height); control for extraneous/confound variables (genetics)
  - High internal validity| low external validity
- Non-Experimental research
  - No manipulation of IV is possible; observe and describe.
  - High external validity| low internal validity
  - Involves research that examines correlations between data (warning: correlations should be used to inform future research, not draw conclusions)

# Exploring data: Descriptives

- Point estimates
  - Mode (most common value)
  - Mean (the average value)
  - Median (the ‘middle’ value in a distribution)
- Range estimates
  - Standard deviation (the ‘average’ distance of a score from the mean)
  - Variance (square of SD)
  - Confidence intervals & standard error
- Let’s look at some examples of descriptive statistics
- Identifying associations/correlations to explore for relationships between data



# Analyzing data: Inferential statistics

- Draw conclusions about a population based on a sample's characteristics.
- Formally, an effect that is **statistically significant** implies that the null hypothesis (the claim that there is no effect) can be rejected.
- Inferences are not fool-proof – one may declare a positive effect when there is no effect in reality (a **false positive**, or a **Type-1 error**). Alternatively, one may report no effect when there actually is a significant difference (a **false negative**, or a **Type-2 error**).


Source: [blogspot.com]

# Drawing conclusions & reporting your findings

- Theories are never ‘proven’ – only strengthened/weakened as theory-generated hypotheses become confirmed/disconfirmed.
- Results of your study can be disseminated in conferences, presentations and, ideally, in peer-reviewed academic journals.
- Become familiar with APA styling when constructing your report