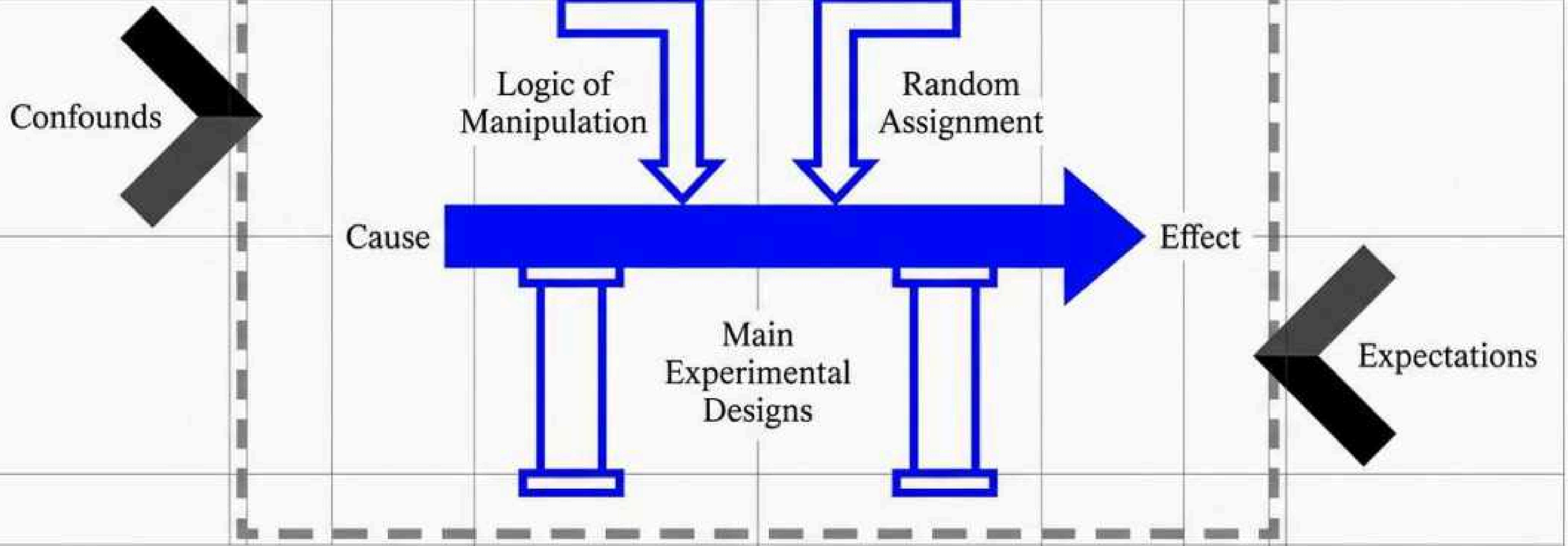
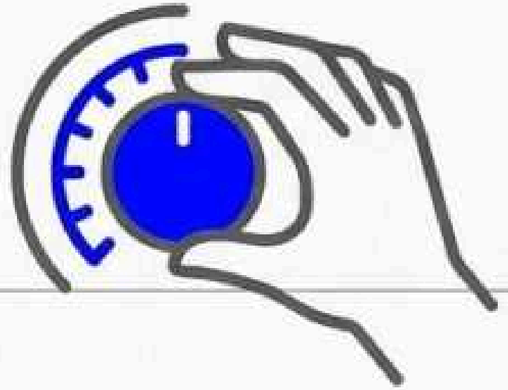
4.1



Experiments provide the strongest method psychologists have for showing that one thing causes another. We examine the logic of this method, its core designs, its defenses against expectations, and its ultimate limitations.

Gemini Notebook

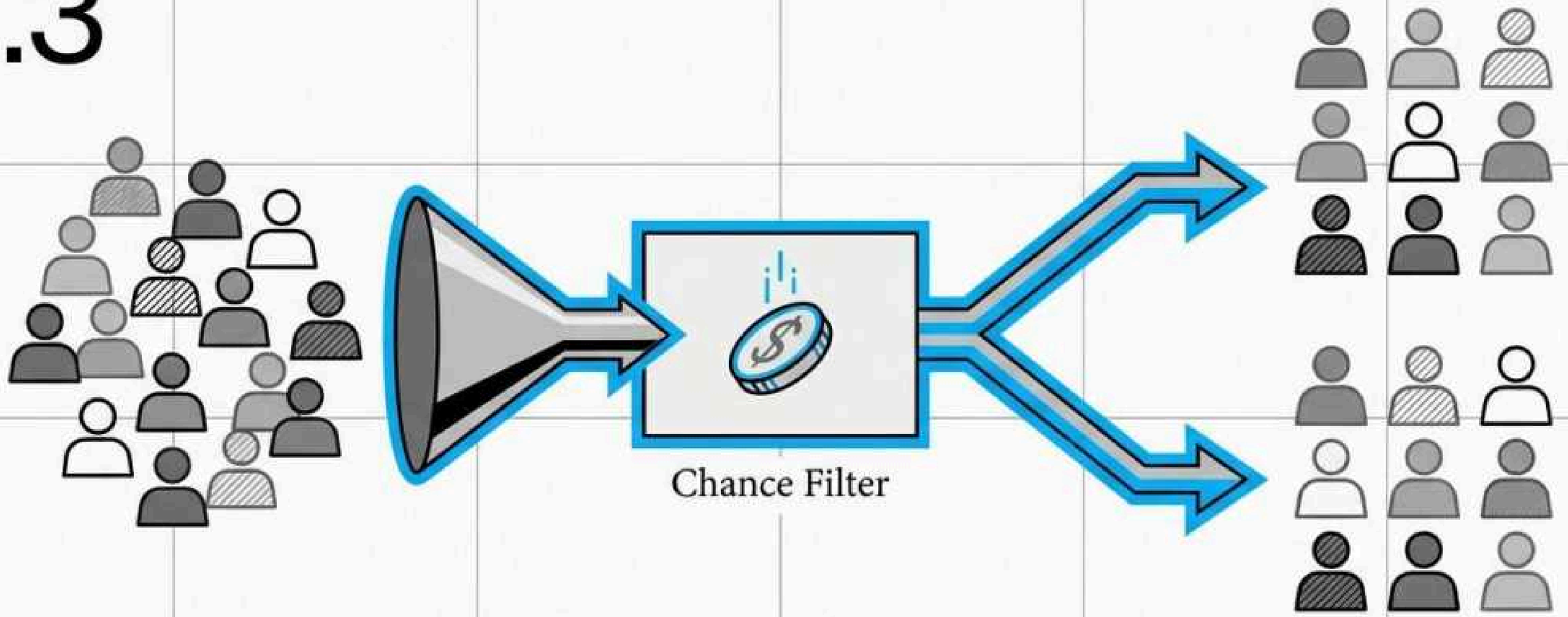
4.2

Independent Variable	Dependent Variable	Extraneous Variables
		
Action: Manipulate	**Action:** Measure	**Action:** Hold Constant

If the groups differ after measurement, the manipulation is the likely reason—provided everything else is made equal.

Gemini Notebook

4.3



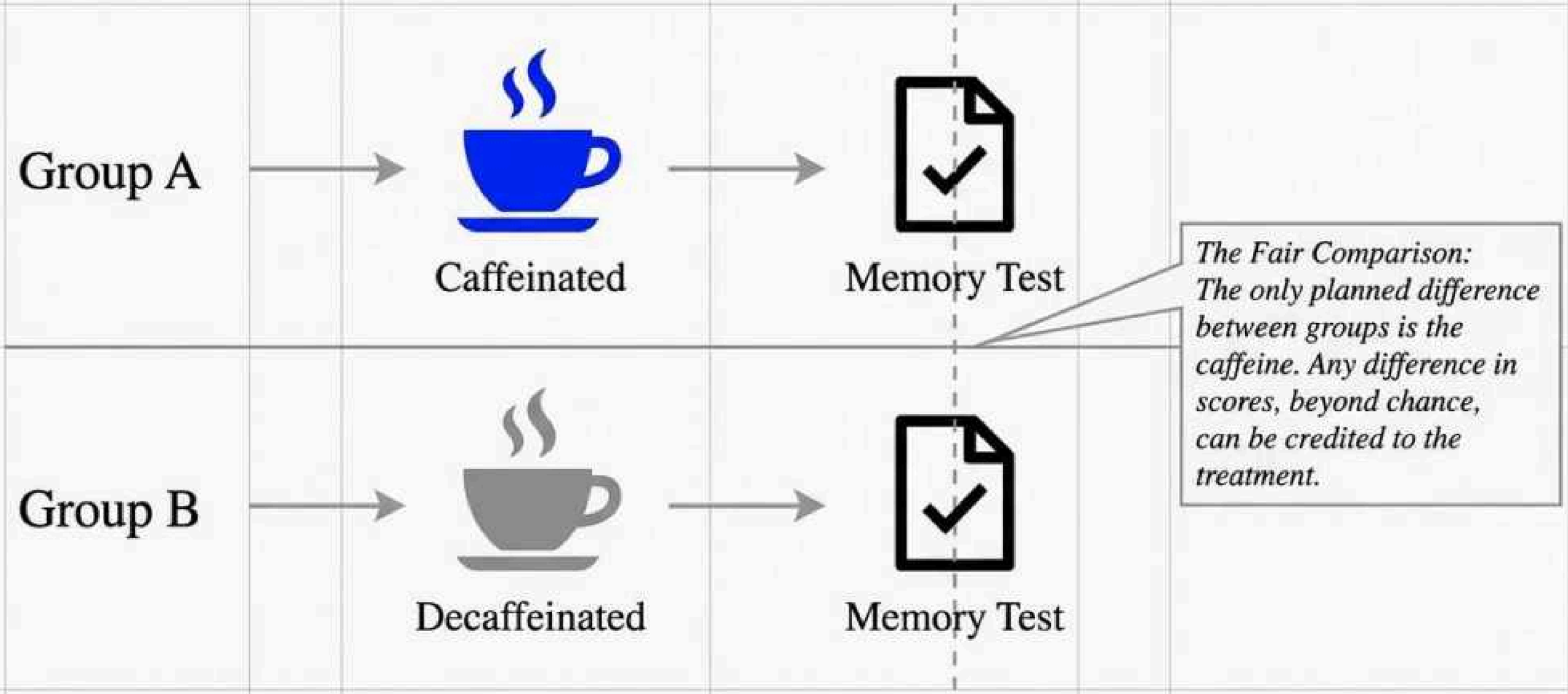
Random Assignment: Placing participants by chance spreads personal differences equally across groups.

Assignment vs. Sampling

Assignment concerns how participants are placed (supports causal claims). *Sampling* concerns who gets into the study.

Gemini Notebook

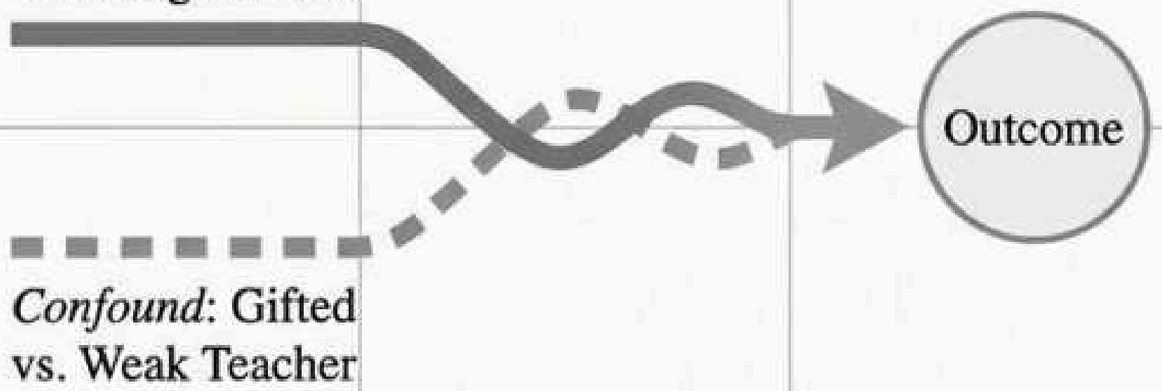
4.4



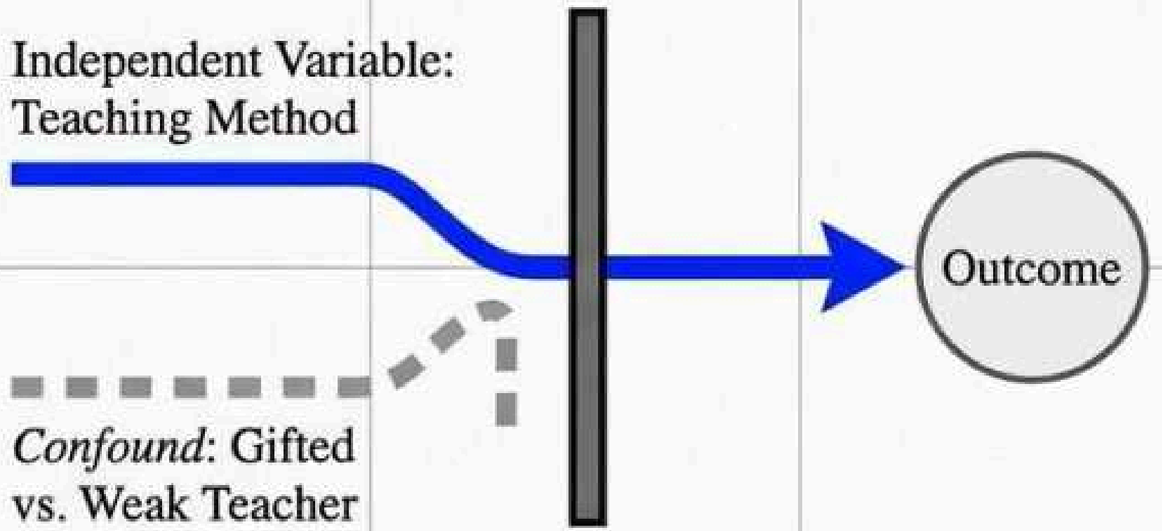
Gemini Notebook

4.5

Confound



Good Design



Confound: A variable that changes along with the independent variable, offering a competing explanation for the result.
If a gifted teacher uses Method A and a weak teacher uses Method B, we cannot tell which variable caused the outcome. Good design ensures conditions differ in one thing only.

Gemini Notebook

4.6

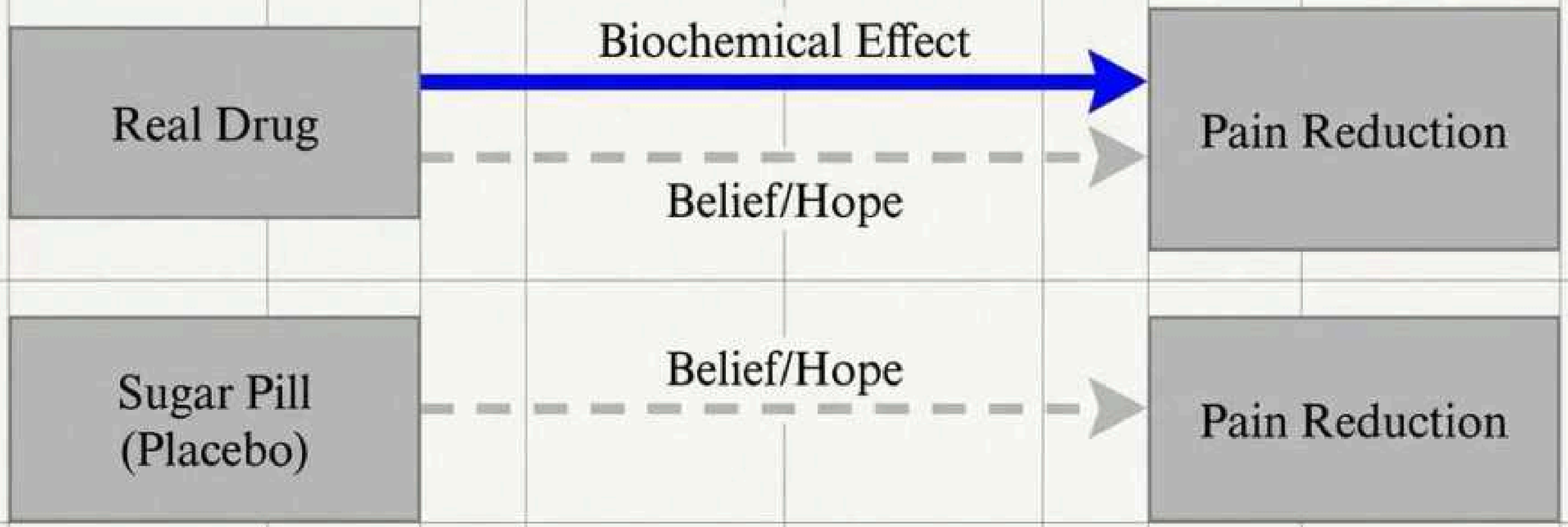
Selection	Groups differ from the start
Attrition	Asymmetrical participant dropout
Maturation & Events	Changes occurring simply over time



Internal Validity is the degree to which a study truly shows the manipulation caused the change. A comparison group serves as the universal shield against these external threats.

Gemini Notebook

4.7



Expectations act as a powerful confound. By administering an identical placebo to the control group, researchers isolate the psychological path, ensuring any extra benefit of the real drug is not due to belief alone.

Gemini Notebook

4.8

	Single-Blind	Double-Blind
Participants	✗	✗
Researchers/Scorers	✓	✗

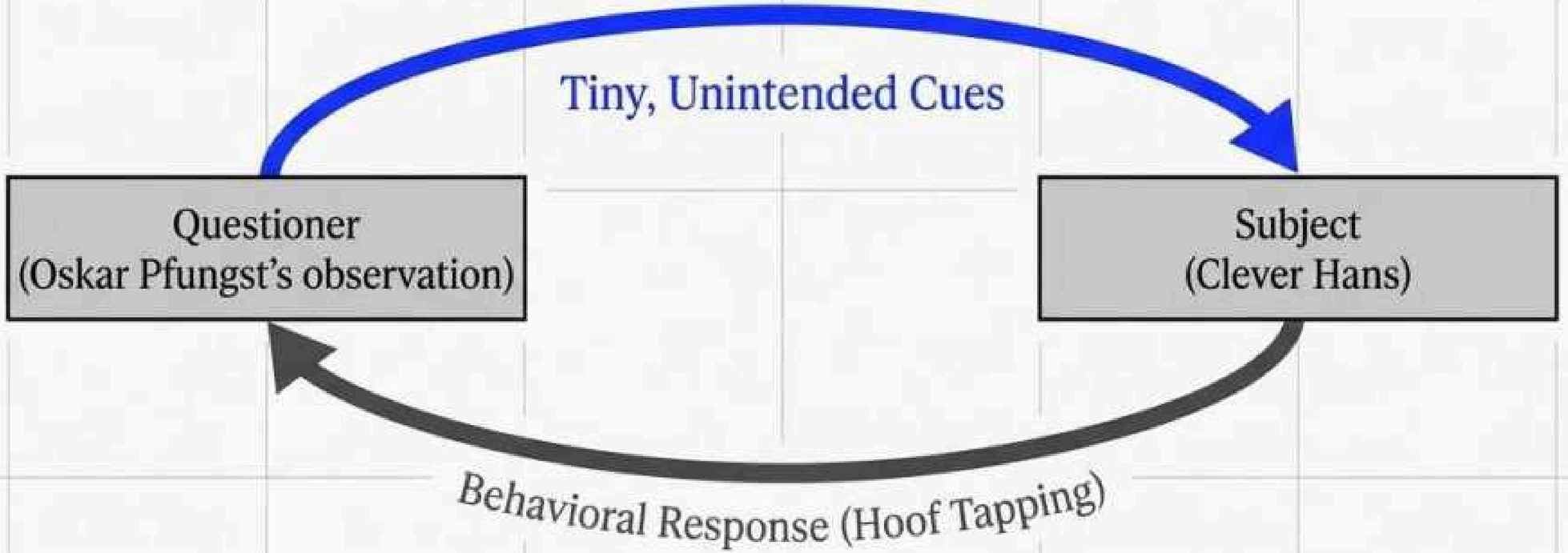
Single-Blind: Participants are unaware of their condition.

Double-Blind: Neither participants nor the administrators/scorers know.

Double-blinding is the gold standard in medical and psychological trials because it prevents hopes from leaking into the data.

Gemini Notebook

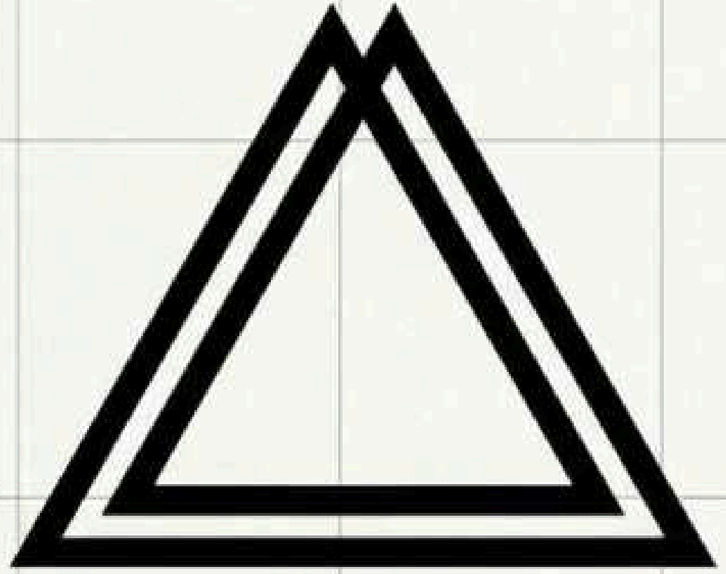
4.9



"Observers can influence results without meaning to. In 1907, psychologist Oskar Pfungst proved that the arithmetic horse Clever Hans was merely reading unintended physical cues from questioners who knew the answers."

Gemini Notebook

4.10



Demand Characteristics

Participants guess the study's purpose and may alter behavior to help or resist.

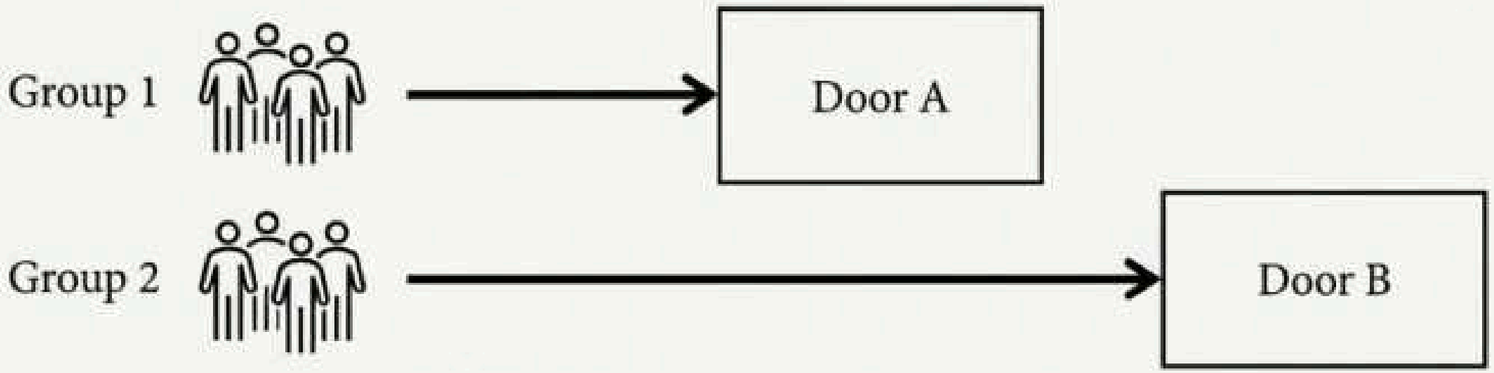
The Solutions

- ☐ Cover stories (disguising true purpose).
- ☐ Measures participants cannot easily control.
- ☐ Deception (when necessary).
- ■ Full post-study debriefing (mandatory disclosure of truth).

Gemini Notebook

4.11

Between-Subjects



Each person experiences only one condition.

Within-Subjects

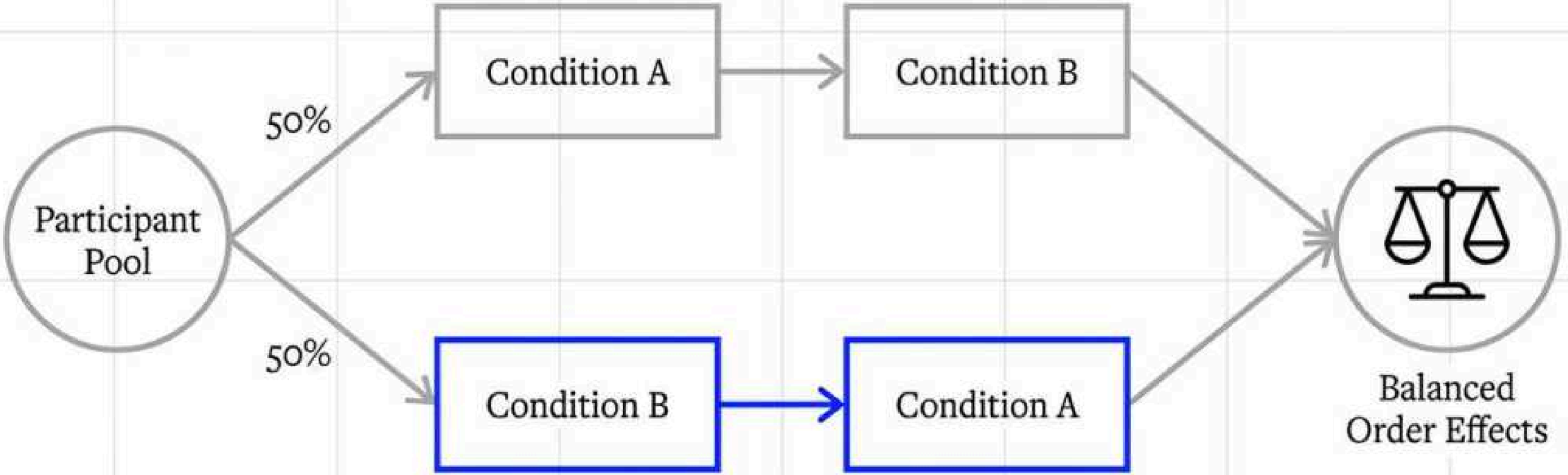


Each person experiences all conditions.

Needs fewer people, removes individual differences, but introduces risks of doing one condition before another (carryover).

Gemini Notebook

4.12

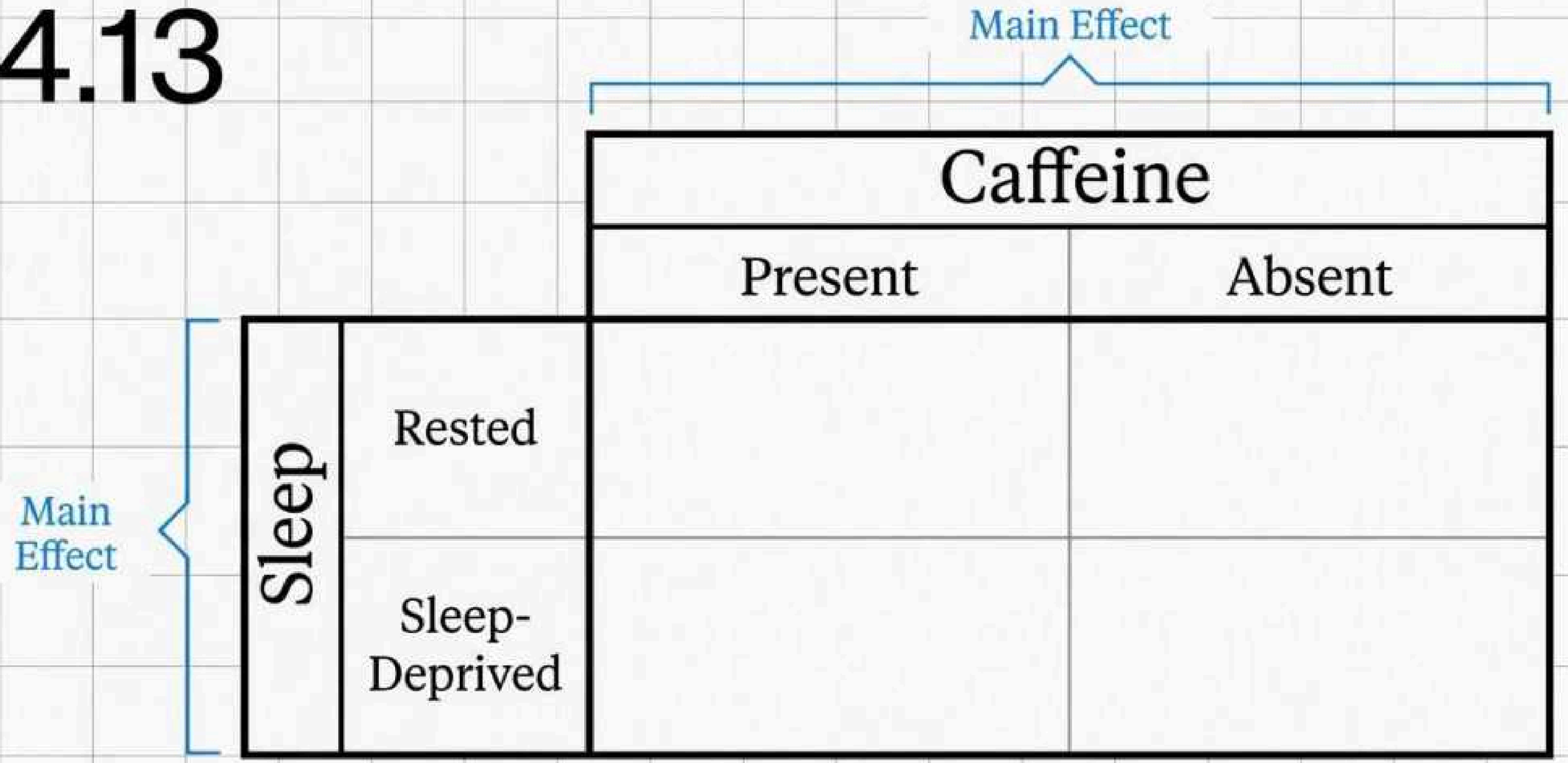


The Threat: People may improve (practice), tire (fatigue), or carry something over from the first task.

The Cure: Counterbalancing ensures that order effects balance out instead of unfairly favoring one condition.

Gemini Notebook

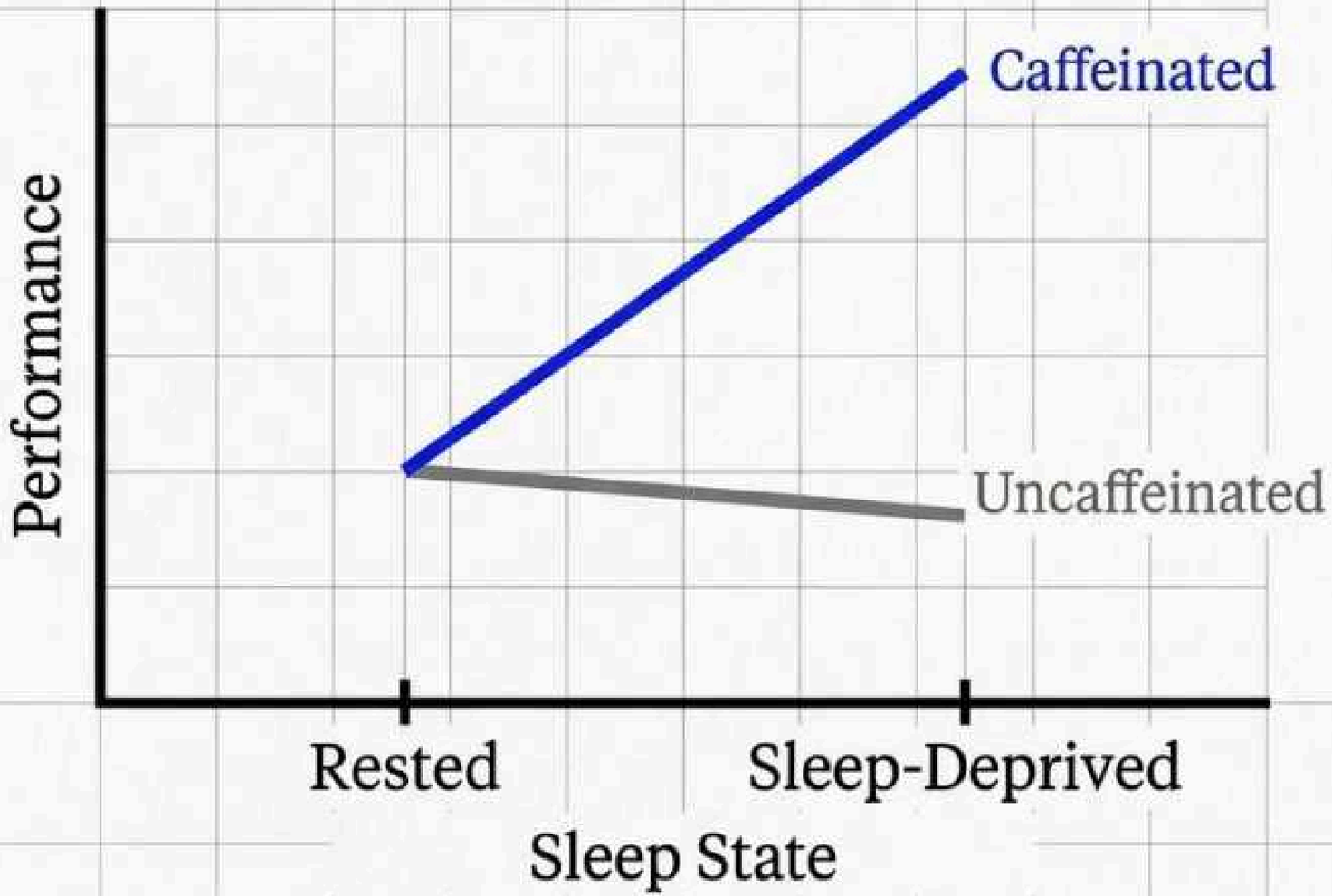
4.13



Factorial Designs manipulate two or more independent variables at once.
The effect of each variable evaluated on its own is called a Main Effect.

Gemini Notebook

4.14



An Interaction occurs when the effect of one variable depends entirely on the level of another. It reveals when and for whom an effect appears, not just whether it does.

Gemini Notebook

4.15

Pilot Test



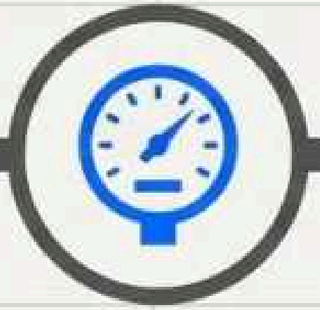
A small trial run to catch problems before the real study.

Standard Script



Ensures every participant has the exact same experience.

Manipulation Check



A question confirming the manipulation actually worked (e.g., verifying the stress condition caused stress).

Gemini Notebook

4.16



(High Control, Lower Realism)

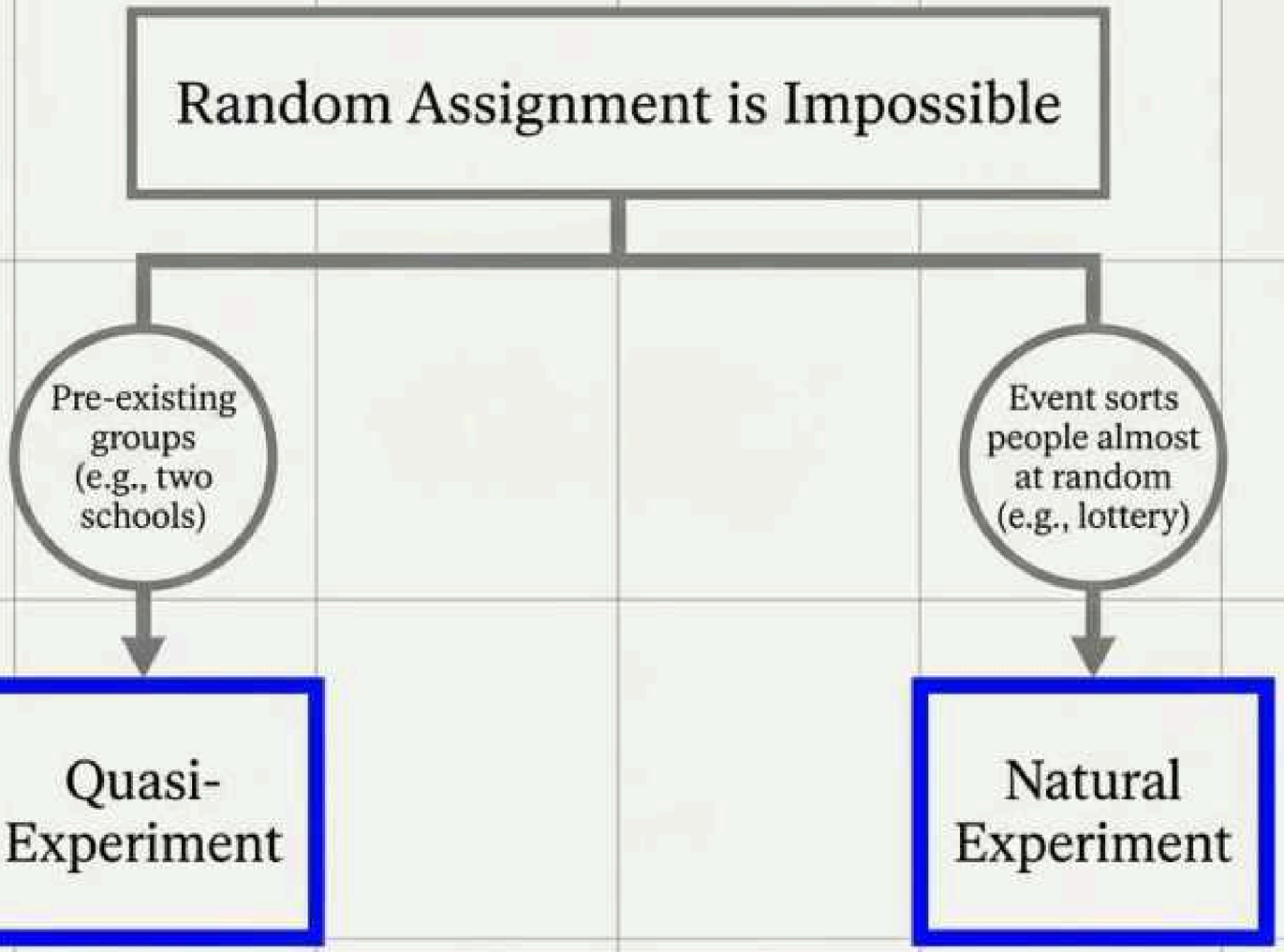
(Low Control, High Realism)

Mundane Realism:	Experimental Realism:
The study resembles the real world.	Participants are genuinely engaged by the task.

External validity asks whether results generalize beyond the study. Researchers must balance control with realism.

Gemini Notebook

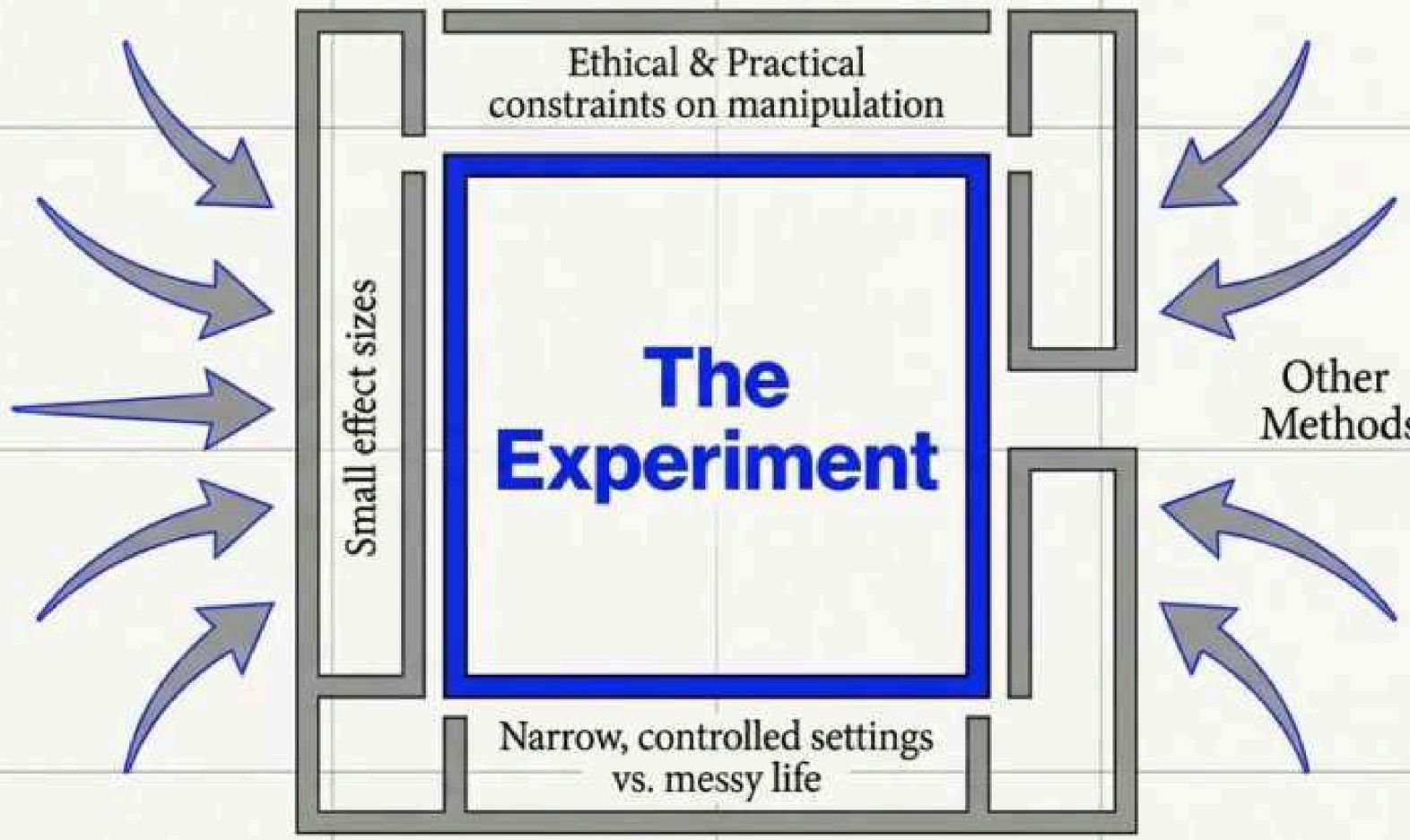
4.17



Because these groups may differ in other unintended ways, causal conclusions are inherently weaker.

Gemini Notebook

4.18



Experiments are the best tool for identifying cause, but one study is rarely decisive.
Conclusions grow strongest when different research methods converge on the same truth.

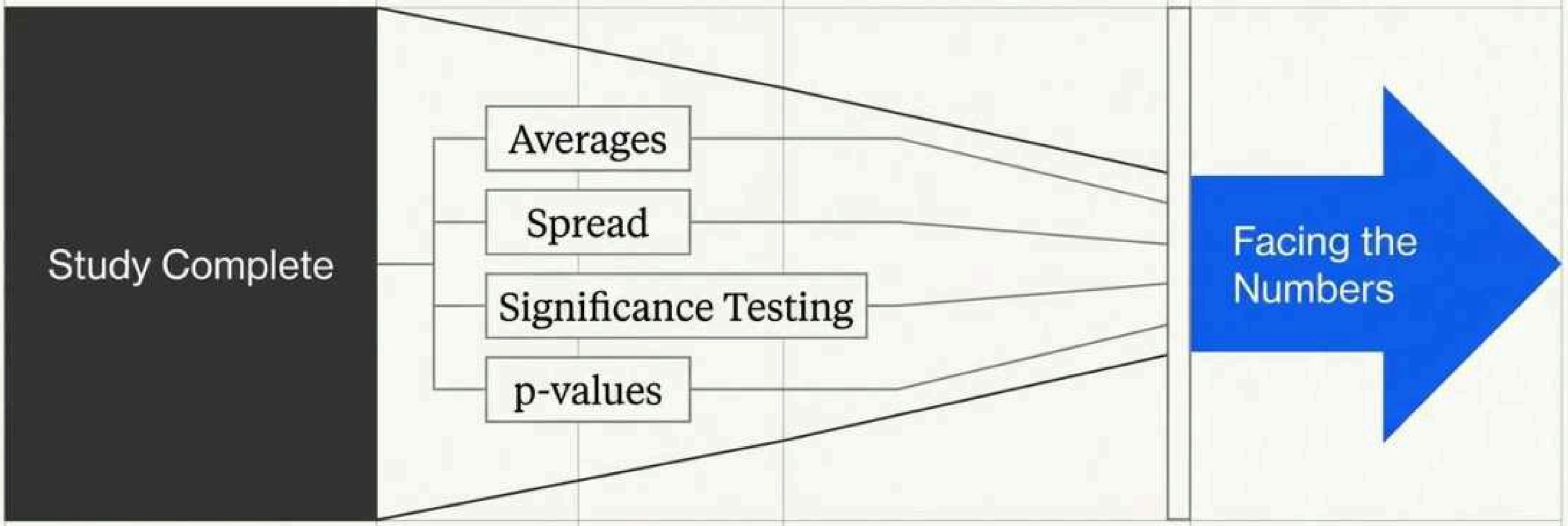
Gemini Notebook

4.19

1 The Core	2 The Controls	3 The Complexities
Independent Variable Dependent Variable Random Assignment (supports causal claims)	Control Groups Blinding Counterbalancing (mitigates confounds, expectations, and order effects)	Factorial Designs (interactions) Quasi-Experiments (when randomizing is impossible)

Gemini Notebook

4.20



Next time: How do we decide whether a difference is real or just chance? We transition from experimental methodology to the logic of numbers.

Gemini Notebook