

## The Logic of the Gap: Mapping the Difference

### 1. The Observation: Where is the Gap?

In this block, we move from looking at a single population to looking at the **Difference** between two groups. Before we ask if a difference is “significant,” we must first visualize where it lives.

**The Big Question:** If there were actually NO difference between these groups in the real world, how often would we see a gap this large just by “random chance”?

### 2. Independent Data: The Two-Hill Logic

**The Setup:** You measure 50 *Iris setosa* and 50 *Iris versicolor*.

- **The Relationship:** Row 1 of Group A has no connection to Row 1 of Group B. They are separate individuals.

**Task 1: The Independent Gap.** Run the first section of `DifferenceLogic.r`. Refer to the resulting plot in R and sketch the two overlapping hills below. Mark the horizontal distance between their peaks as your “Observed Gap.”

*Sketch the Two Hills here based on the R plot.*

### 3. Paired Data: The Single-Hill Logic

**The Setup:** You measure the *exact same 50 plants* in the Morning and again in the Evening.

- **The Relationship:** Row 1 in the Morning is the **exact same plant** as Row 1 in the Evening.
- **The Mapping:** You subtract the pairs *first* ( $d = x_{pm} - x_{am}$ ) to create a single “Hill of Change”.

**Task 2: The Paired Change.** Run the second section of `DifferenceLogic.r`. Refer to the plot in R and sketch the single distribution centered at 0. Mark where your calculated “Change” sits on the x-axis.

*Sketch the Hill of Change here based on the R plot.*

### 4. Lead Observer’s Reflection

**The Overlap Check:** Look at your Independent sketch. If a new flower is 5.2cm, how much overlap exists between the two species?

**The Direction of Change:** In your Paired sketch, the center line marks **Zero Change**. If the entire hill is to the right of zero, what does that tell you about the plants?

**Lead Observer Pro-Tip:** In the next block, we use the *t.test* to turn these visual gaps into a final probability report.