Any hypothesis test:
1. Hypotheses
2. Test statistic
3. p-value
4. Conclusion

Model
\[ Y_{ij} = \mu_i + \epsilon_{ij} \]
or
\[ Y_{ij} = \mu_j + \epsilon_{ij} \]

Solution

Tested Variances not normality!
Test normality & done.

Paired data

Subject

Caliper

\[
\begin{array}{c|c|c}
Subject & x & x \\
1 & x & x \\
2 & \end{array}
\]

\[ H_0: \mu_1 = \mu_2 \quad \text{equiv.} \quad H_0: S_i = 0 \quad \text{equiv.} \quad H_0: S_i \text{ not 0} \]

plot data 1st.

\[ t = 2.3 \quad \text{reject } H_0, \quad p = .0372 < \alpha = .05 \quad \text{p < } \alpha. \]
Model: $Y_{ij} = \mu + \alpha_i + \epsilon_{ij}$

can simplify by considering differences.

Either (paired)

$H_0: \mu_d = 0$  
$H_1: \mu_d \neq 0$

emphasizes paired difference.

Randomization + Inference
In ideal world of Stats...

1. Randomly select sample from population. 
   Every sample of size $n$ equally likely.

2. Randomize subjects in our sample to the trt. groups. 
   Every assignment to groups equally likely.

3. Randomize order of application of trt.

4. Randomize test order. 
   All orders equally likely.

Randomization eliminates systematic bias in the experiment.

What do we really do? Step 2!
Why not step 1?
- Clinical trials. Physical constraint.
- Patients all over US, or E.U.
- Population "hypothetical"? -
  - e.g. New production process, no population exists yet.

Why not steps 3 & 4, randomize order?
- Too inconvenient in many situations to randomize order.
- Testing usually not necessary.

Why differences?
\[
\gamma_{ij} - \gamma_{2j} = (\mu + C_i + S_i + \varepsilon_{ij}) - (\mu + C_2 + S_j + \varepsilon_{2j})
= (C_i - C_2) + (\varepsilon_{ij} - \varepsilon_{2j})
\]

If consider differences only have 1 variance, so don't need to check equality. But ....