

POLS 641

Introductory Political Analysis

Bonus: Alison Horst T-Tests

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2-SAMPLE T-TESTS

teaching assistants:

@allison-horst



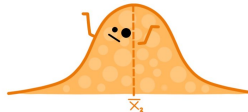
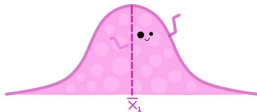
LET'S START **HERE**: if random samples are drawn from populations w/ the same mean...

Then it is more likely that the 2 sample means will be close together...

(i.e. the same population)



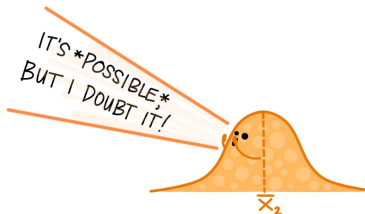
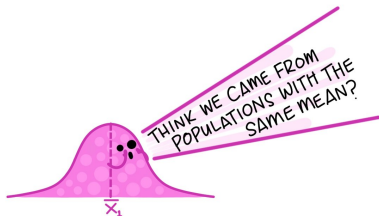
...and it is less likely (but always possible!) that the sample means will be far apart.



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in OTHER WORDS... The more different the sample means are*, the less likely it is they were drawn from populations w/ the same mean.

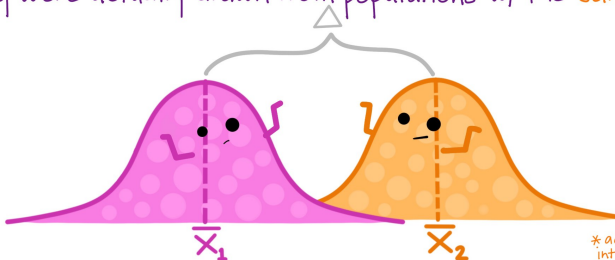
*(when taking into account sample spread + size)
‡ assuming we've randomly sampled



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So for our 2 random samples, we ask:

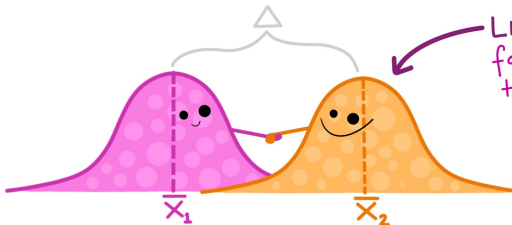
WHAT IS THE PROBABILITY OF GETTING 2 SAMPLE
MEANS THAT ARE AT LEAST THIS DIFFERENT,*
if they were actually drawn from populations w/ the same mean?



* again, when taking
into account sample
spread & size, +
assumptions...

That's our p-value!

WHAT IS THE PROBABILITY OF GETTING 2 SAMPLE
MEANS THAT ARE AT LEAST THIS DIFFERENT,
if they were actually drawn from populations w/ the same mean?



LIKE: If a 2-sample t-test
for these samples yields $p=0.03$,
that means there is a
3% chance of getting means
that are at least this
different, if they're drawn
from populations with
the same mean.

Question:

WHEN DO WE HAVE ENOUGH EVIDENCE TO SAY
THERE IS A SIGNIFICANT DIFFERENCE?

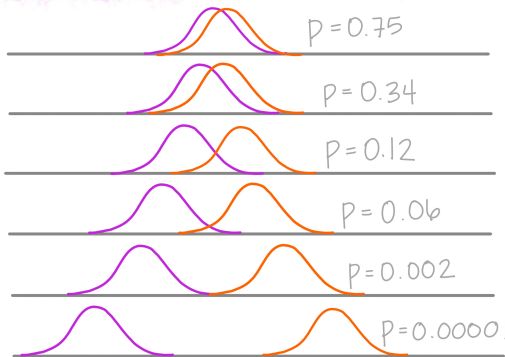
Answer:

WHEN OUR P-VALUE IS BELOW OUR
SELECTED SIGNIFICANCE LEVEL (α),
USUALLY (BUT NOT ALWAYS) = 0.05.

Which means:

IF THE PROBABILITY (p-value) OF FINDING AT LEAST OUR
DIFFERENCE IN SAMPLE MEANS (IF THEY WERE DRAWN
FROM POPULATIONS WITH THE SAME MEANS) IS
LESS THAN 5%, THAT'S ENOUGH EVIDENCE FOR
US TO DECIDE THEY ARE LIKELY FROM POPULATIONS
WITH UNEQUAL MEANS.

P-VALUES, SCHEMATICALLY:



Higher
p-values

(HIGHER PROBABILITY OF 2
SAMPLE MEANS BEING AT
LEAST THIS DIFFERENT, IF
DRAWN FROM POPULATIONS
WITH THE SAME MEAN)

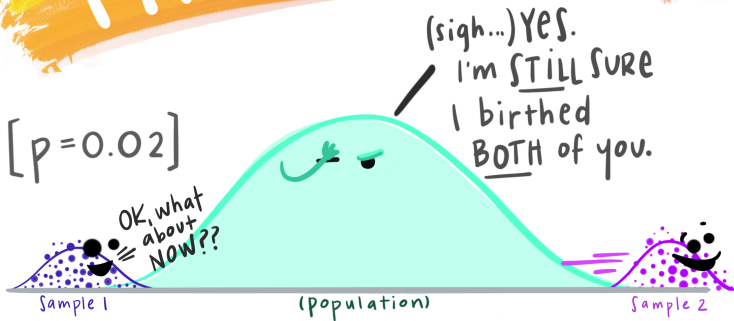
= LESS EVIDENCE
OF DIFFERENCES
BETWEEN
POPULATION MEANS

Lower
p-values

(LOWER PROBABILITY OF 2
SAMPLE MEANS BEING AT
LEAST THIS DIFFERENT, IF
DRAWN FROM POPULATIONS
WITH THE SAME MEAN)

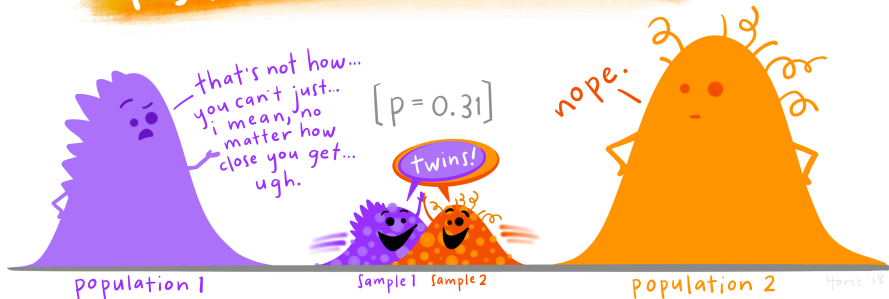
= MORE EVIDENCE
OF DIFFERENCES
BETWEEN
POPULATION MEANS

TYPE 1 ERRORS



Horst '18

TYPE II ERRORS:



All credit to Alison Horst

<https://github.com/allisonhorst>