In Class Lab One

Collect Data

10 goal directed reaches with eyes open as fast as possible

10 goal directed reaches with eyes closes as fast as possible

Estimate accuracy to 0.1 if possible.
Counterbalance order
Enter scores into EXCEL

Participant Data

Participant Mean
Participant Standard Deviation

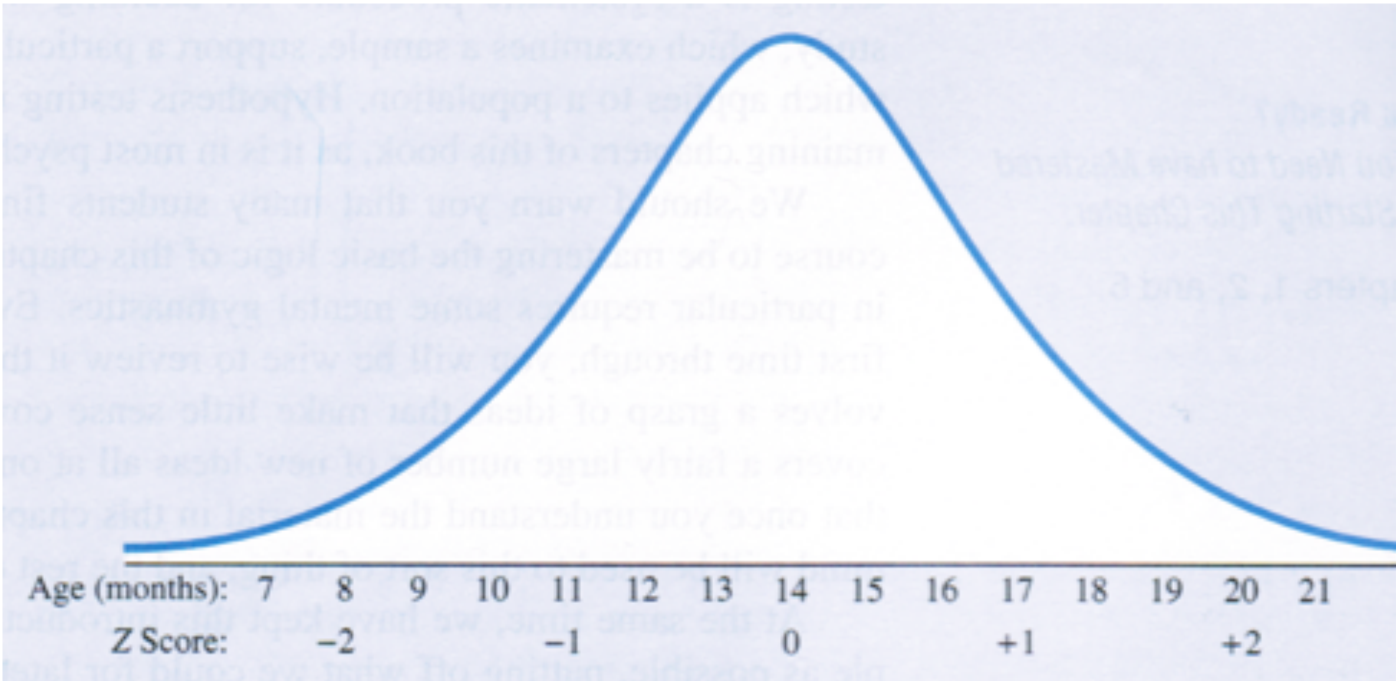
Condition Data

Condition Mean
Condition Standard Deviation

The Logic of Hypothesis Testing

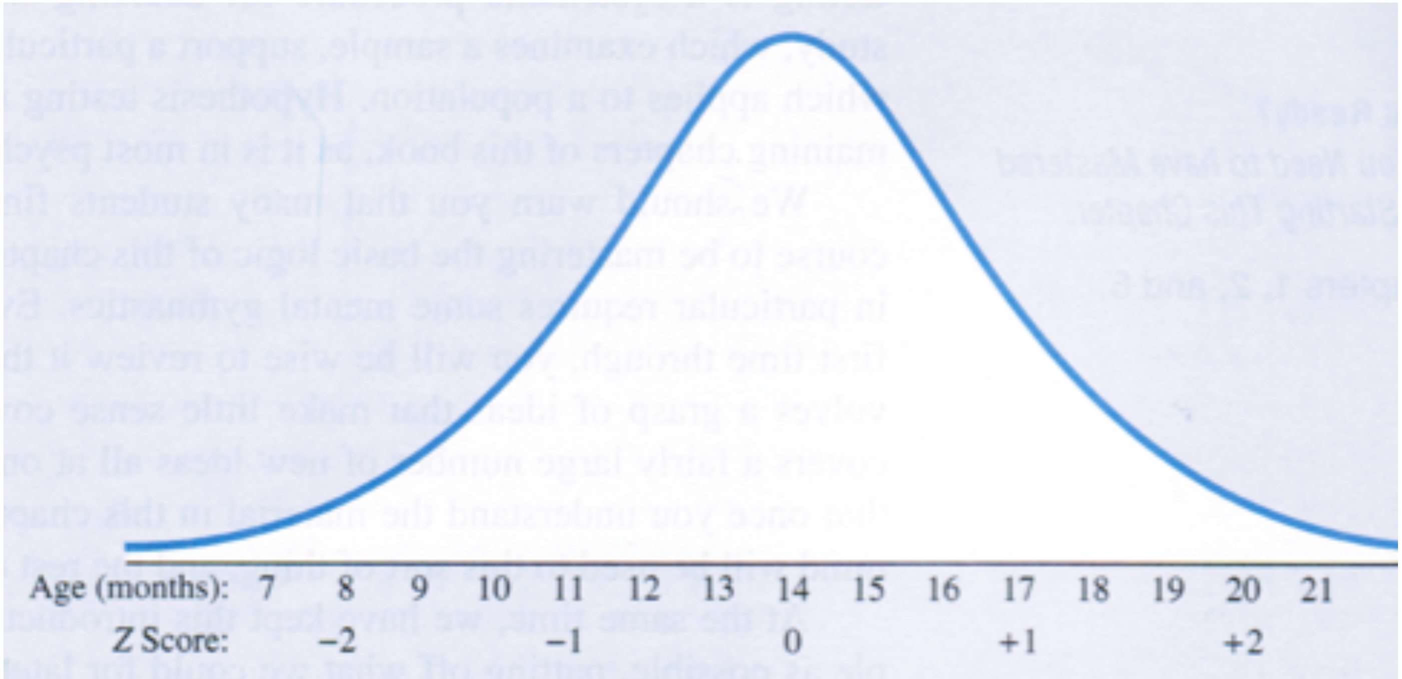
How do we know if our data differs from a population?

The Logic of Hypothesis Testing



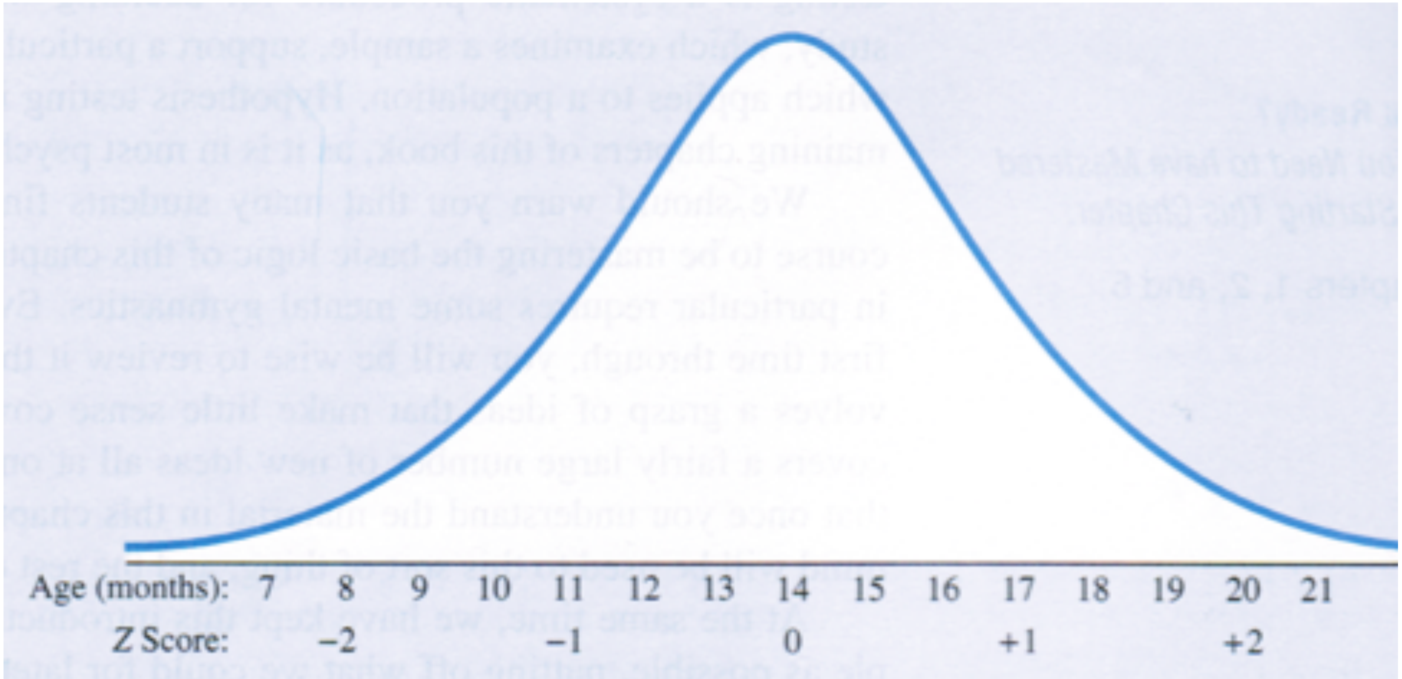
Let’s suppose the mean age for babies walking is 14 months.

We are going to try an experimental intervention that seeks to reduce that age.



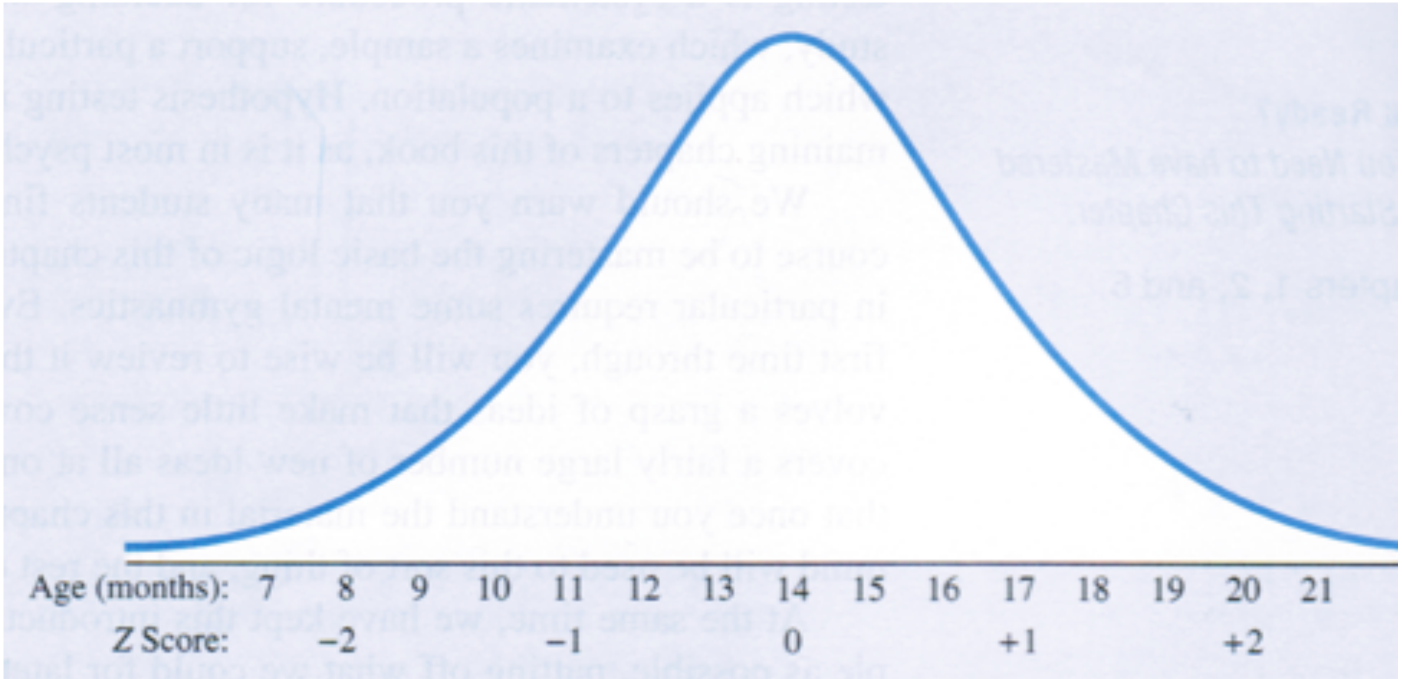
So we generate two hypotheses:

1) Our treatment does not work
2) Our treatment works



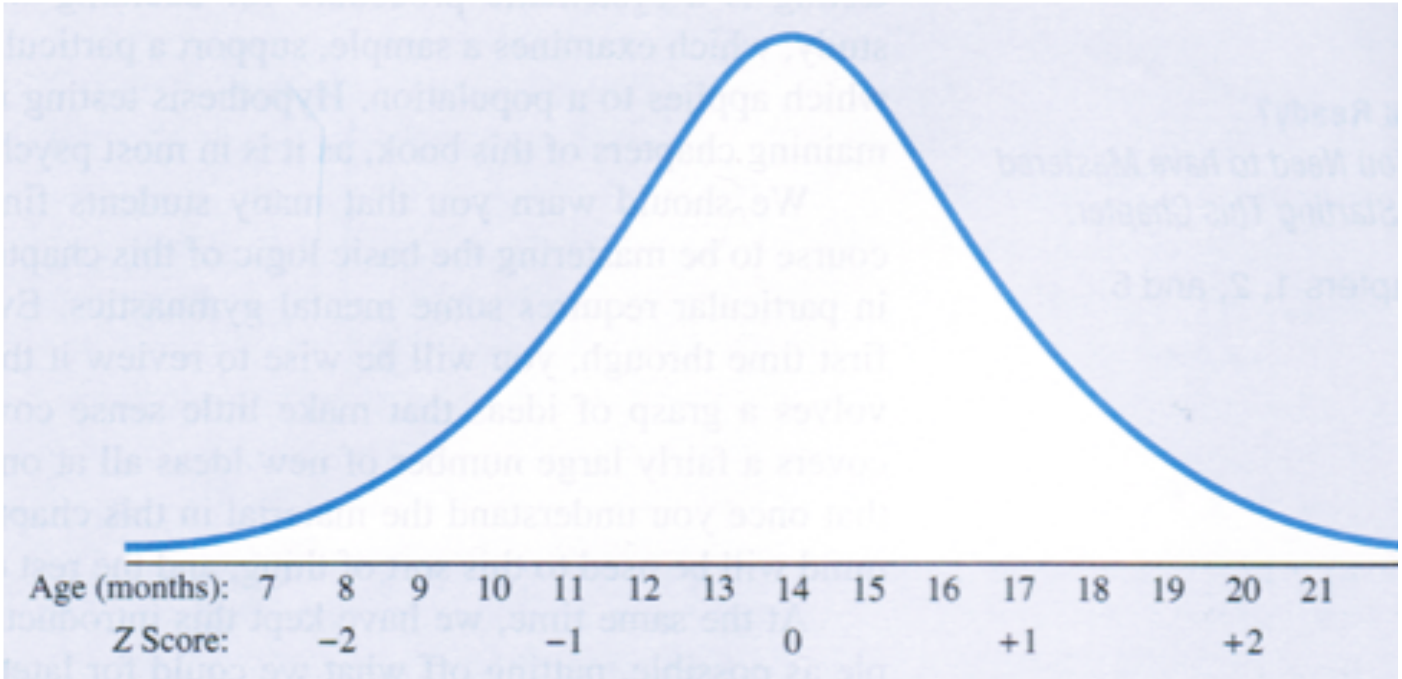
Lets think of this now in terms of populations:

Population One, babies who did not get our treatment
Population Two, babies who did get our treatment



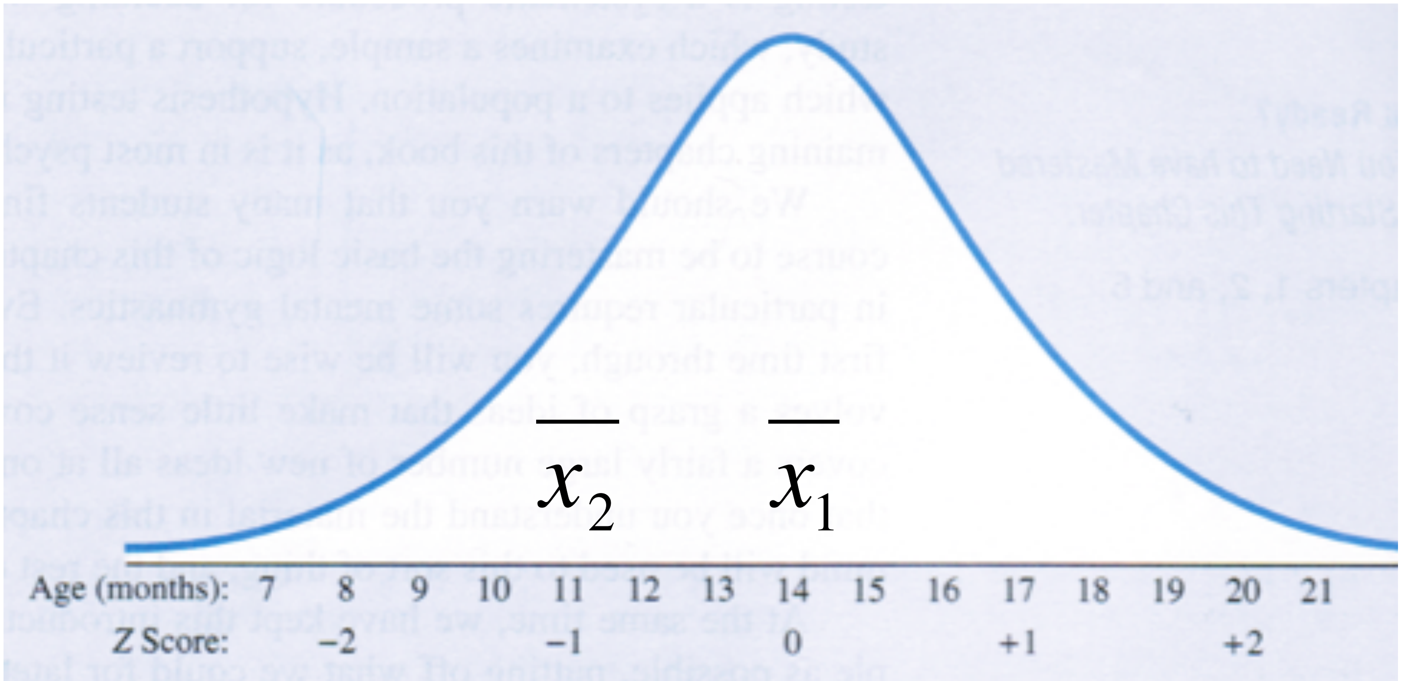
And we can quantify a descriptive statistic that is representative of our population, the mean age at which they begin walking

Population One: mean age of walking: μ_1
Population Two: mean age of walking: μ_2



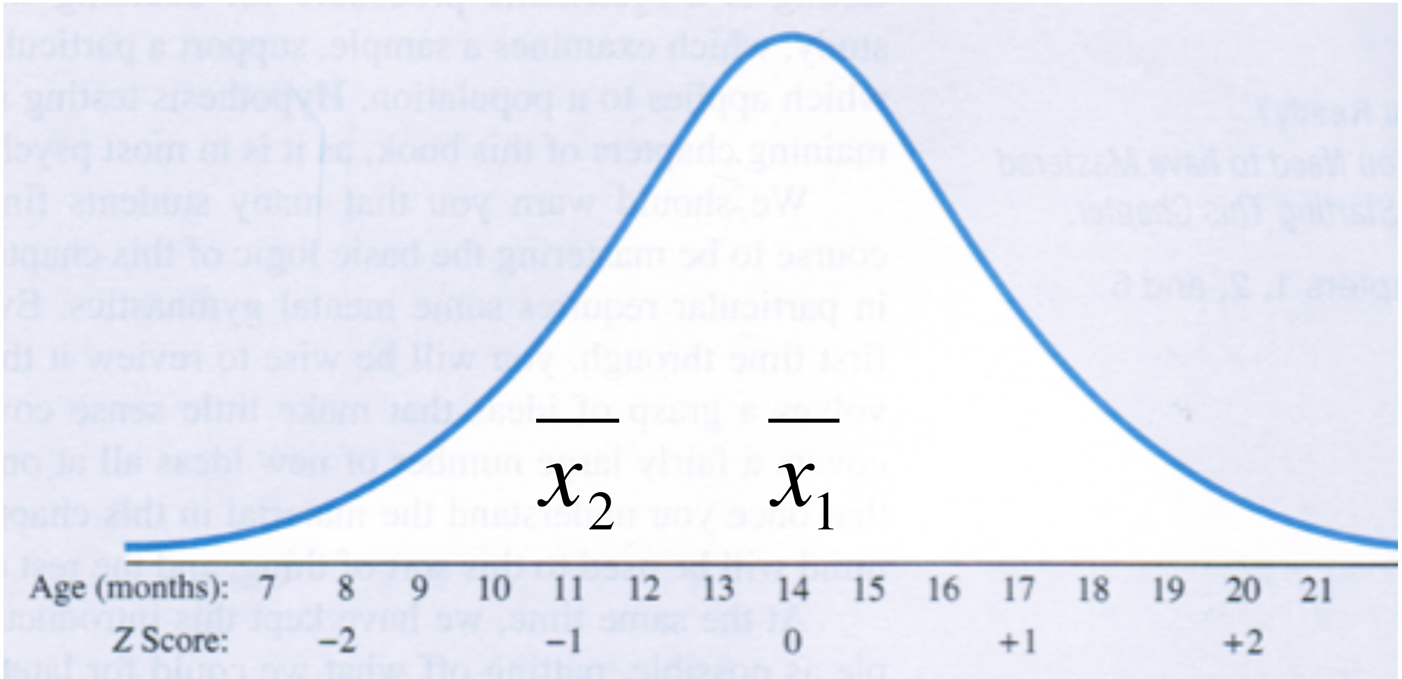
We typically frame this within the context of the null and alternative hypotheses:

1) H_0: The Null Hypothesis: Our treatment does not work: $\mu_1 = \mu_2$
2) H_1: The Alternative Hypothesis: Our treatment works: $\mu_1 \neq \mu_2$



So, let’s say we run the study, and we obtain the following data.

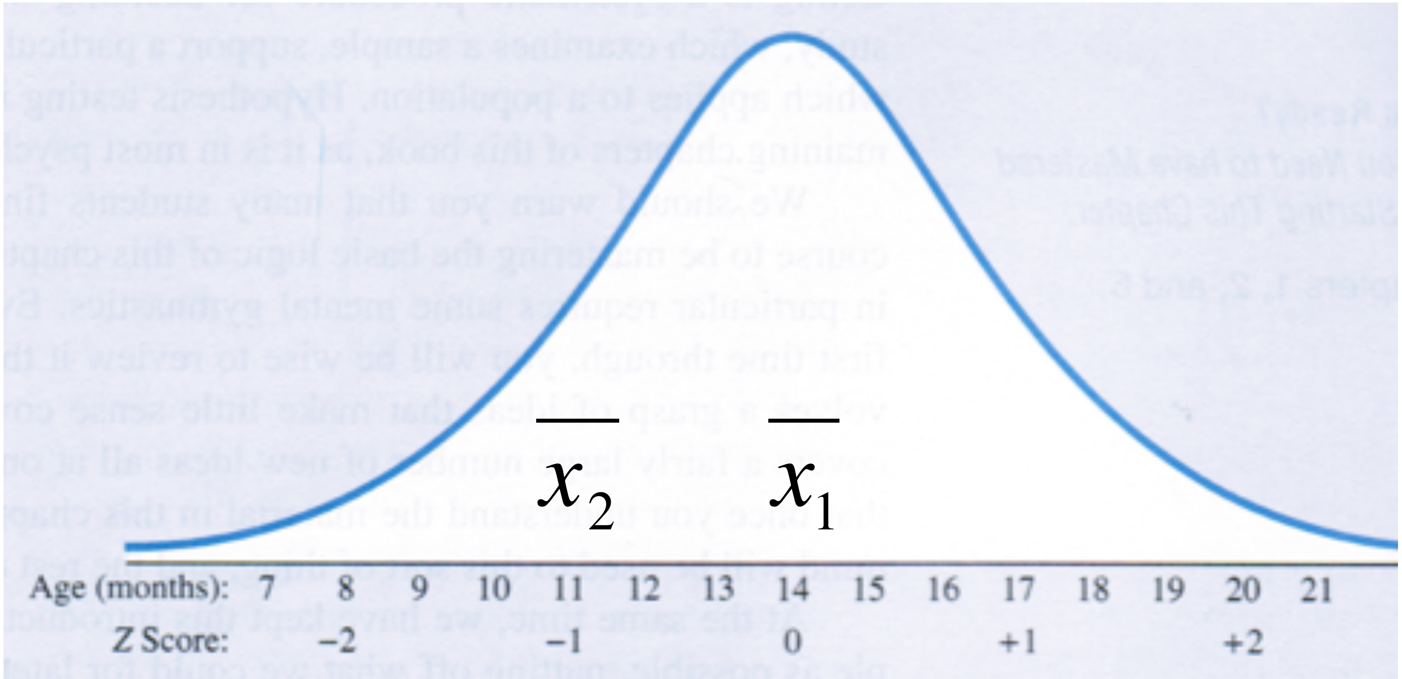
How do we know if our treatment worked?



Here's the weird bit, we first want to find out the probability of getting our result if the null hypothesis is true.

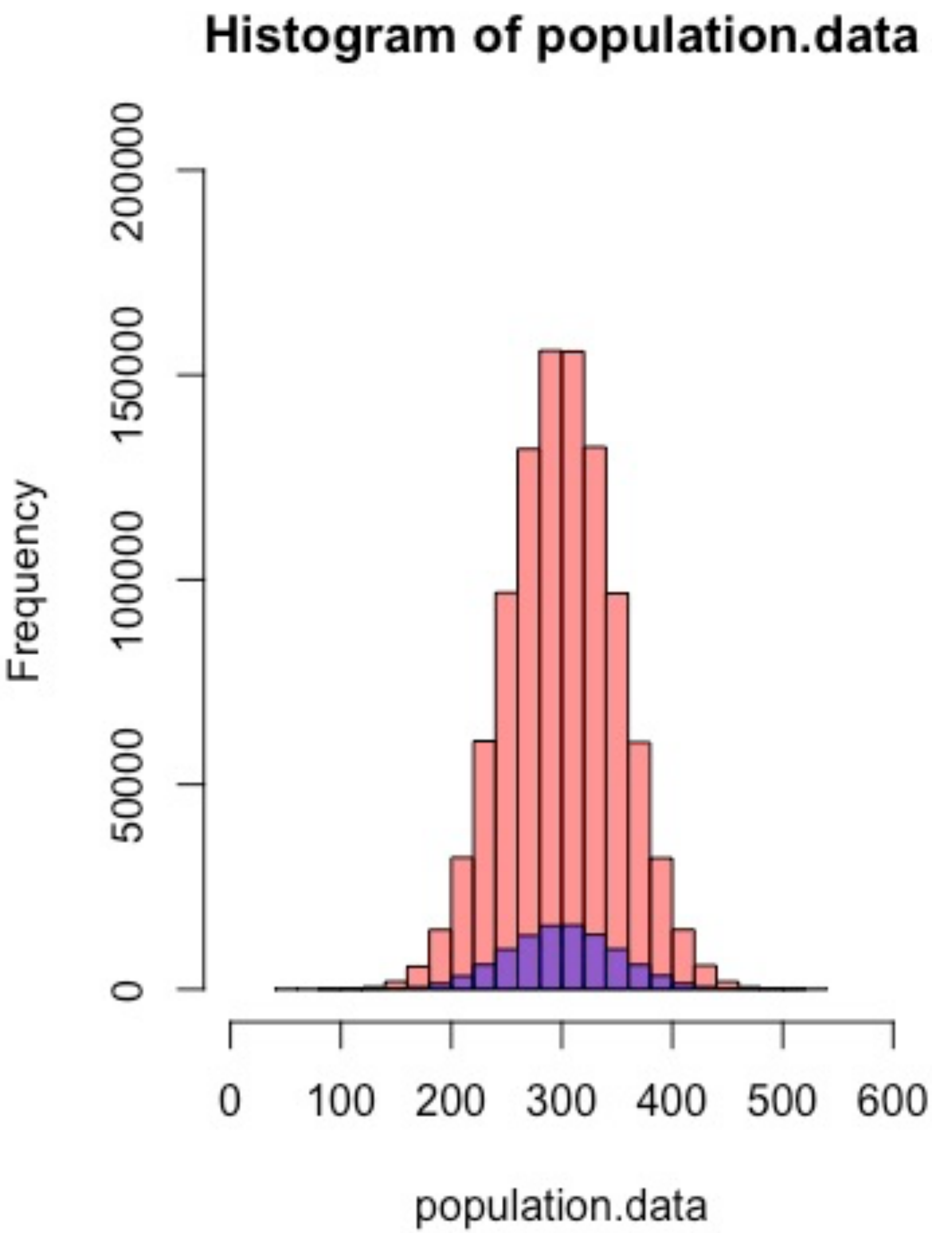
We call this our "critical value"

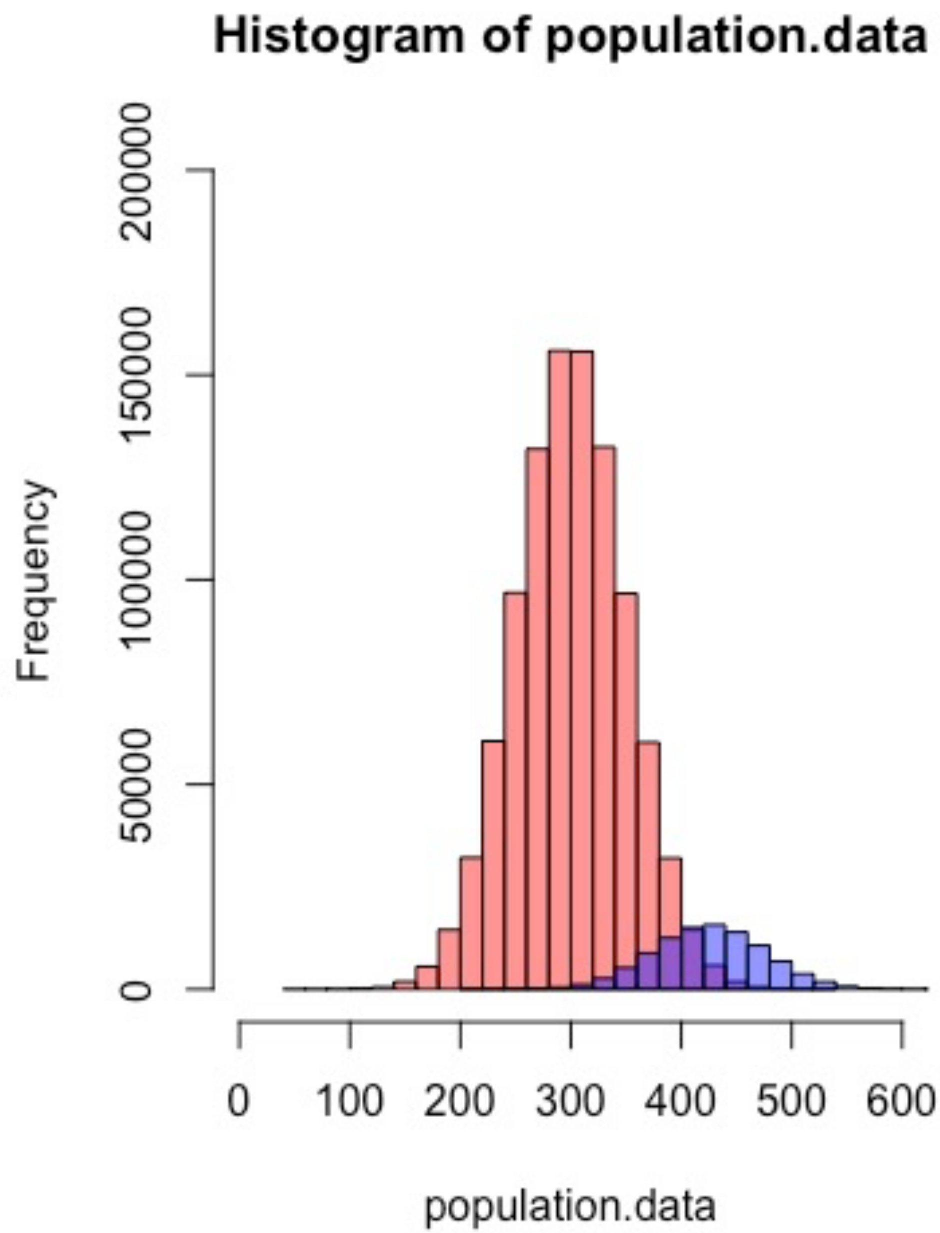
The probability of our results at which we will discard the null hypothesis and accept the alternative hypothesis.



0.05

The point at which a sample score is so extreme that we discard the null hypothesis


Histogram of population.data
Frequency
0
50000
100000
150000
200000
0
100
200
300
400
500
600
population.data


Histogram of population.data
Frequency
0
50000
100000
150000
200000
0
100
200
300
400
500
600
population.data

What do we do?

We compute some statistics <u>from our data</u> for which there is a known probability of scores given a specific sample size.

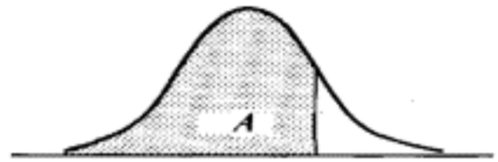
$$t = \frac{\text{sample mean} - \text{population mean}}{\text{standard deviation of sample}}$$

What do we do?

We compute some statistics from our data for which there is a known probability of scores given a specific sample size.

t = sample mean 1 – sample mean 2
      ----
      standard deviation of sample

Entry is $t(A; \nu)$ where $P\{t(\nu) \le t(A; \nu)\} = A$



	A						
ν	.60	.70	.80	.85	.90	.95	.975
1	0.325	0.727	1.376	1.963	3.078	6.314	12.706
2	0.289	0.617	1.061	1.386	1.886	2.920	4.303
3	0.277	0.584	0.978	1.250	1.638	2.353	3.182
4	0.271	0.569	0.941	1.190	1.533	2.132	2.776
5	0.267	0.559	0.920	1.156	1.476	2.015	2.571
6	0.265	0.553	0.906	1.134	1.440	1.943	2.447
7	0.263	0.549	0.896	1.119	1.415	1.895	2.365
8	0.262	0.546	0.889	1.108	1.397	1.860	2.306
9	0.261	0.543	0.883	1.100	1.383	1.833	2.262
10	0.260	0.542	0.879	1.093	1.372	1.812	2.228
11	0.260	0.540	0.876	1.088	1.363	1.796	2.201
12	0.259	0.539	0.873	1.083	1.356	1.782	2.179
13	0.259	0.537	0.870	1.079	1.350	1.771	2.160
14	0.258	0.537	0.868	1.076	1.345	1.761	2.145
15	0.258	0.536	0.866	1.074	1.341	1.753	2.131
16	0.258	0.535	0.865	1.071	1.337	1.746	2.120
17	0.257	0.534	0.863	1.069	1.333	1.740	2.110
18	0.257	0.534	0.862	1.067	1.330	1.734	2.101
19	0.257	0.533	0.861	1.066	1.328	1.729	2.093
20	0.257	0.533	0.860	1.064	1.325	1.725	2.086
21	0.257	0.532	0.859	1.063	1.323	1.721	2.080
22	0.256	0.532	0.858	1.061	1.321	1.717	2.074
23	0.256	0.532	0.858	1.060	1.319	1.714	2.069
24	0.256	0.531	0.857	1.059	1.318	1.711	2.064
25	0.256	0.531	0.856	1.058	1.316	1.708	2.060
26	0.256	0.531	0.856	1.058	1.315	1.706	2.056
27	0.256	0.531	0.855	1.057	1.314	1.703	2.052
28	0.256	0.530	0.855	1.056	1.313	1.701	2.048
29	0.256	0.530	0.854	1.055	1.311	1.699	2.045
30	0.256	0.530	0.854	1.055	1.310	1.697	2.042
40	0.255	0.529	0.851	1.050	1.303	1.684	2.021
60	0.254	0.527	0.848	1.045	1.296	1.671	2.000
120	0.254	0.526	0.845	1.041	1.289	1.658	1.980
∞	0.253	0.524	0.842	1.036	1.282	1.645	1.960

And then we can calculate the probability of getting the test statistic we have obtained and evaluating it against alpha.

alpha = 0.05

if $p < 0.05$ then we say our test statistic is different

If $p > 0.05$ then we say our test statistic is the same

Three flavours

1. Single Sample
2. Dependent Samples
3. Independent Samples

Single Sample TTest

You want to compare a sample to a known population mean but you DO NOT know the population standard deviation.

Dependent Samples T-Test
(Paired)
(Correlated Groups)

Paired Samples TTest

You want to compare two related or dependent samples.

i) all people have been measured at two different time points

ii) all people have completed two experimental conditions

Independent Samples T-Test (Between)

Independent Samples TTest

You want to compare two independent samples.

T-Tests in EXCEL

http://www.krigolsonteaching.com/data-analysis.html