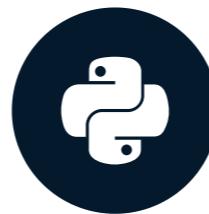


# Finch beaks and the need for statistics

STATISTICAL THINKING IN PYTHON (PART 2)

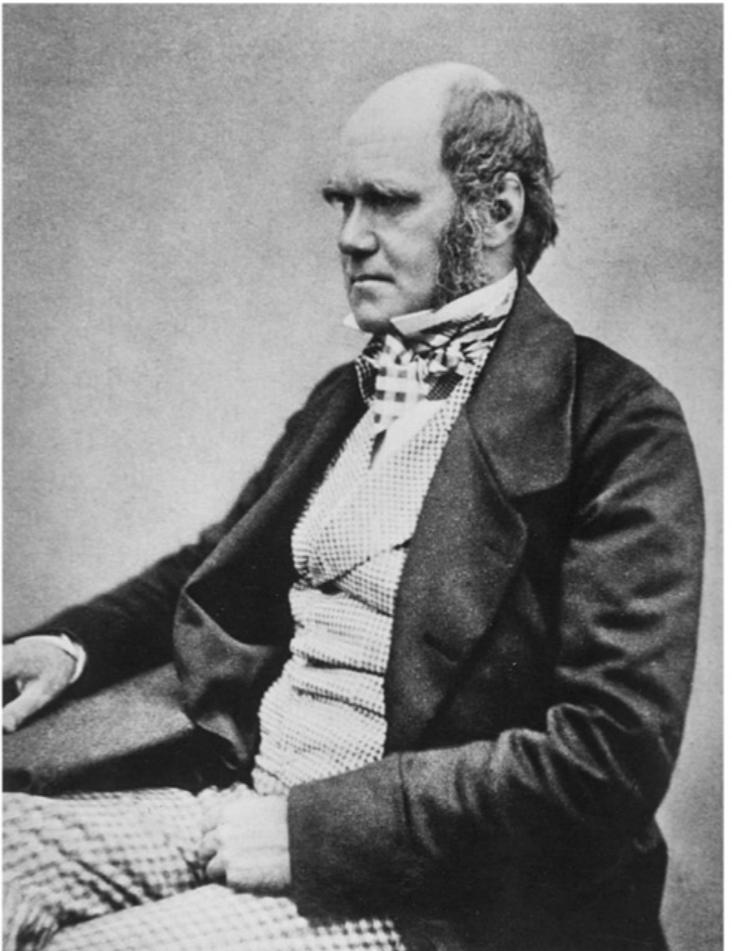


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# Your well-equipped toolbox

- Graphical and quantitative EDA
- Parameter estimation
- Confidence interval calculation
- Hypothesis testing



<sup>1</sup> Image: Public domain, US



<sup>1</sup> Image: NASA

# The island of Daphne Major



<sup>1</sup> Image: Grant and Grant, 2014

# The finches of Daphne Major



*Geospiza fortis*



*Geospiza scandens*

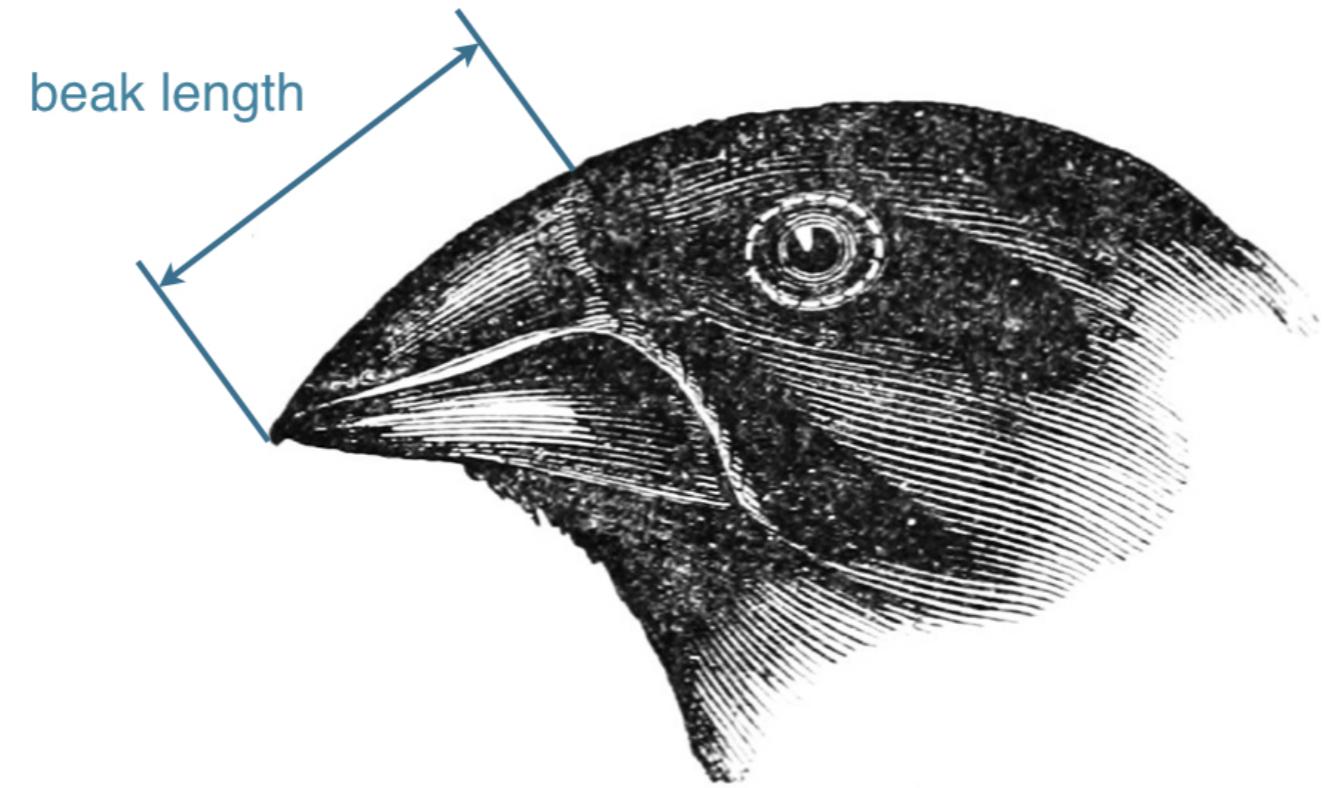
<sup>1</sup> Source: John Gould, public domain

# Our data source

- Peter and Rosemary Grant
  - 40 Years of Evolution: Darwin's Finches on Daphne Major Island
  - Princeton University Press, 2014
- Data acquired from Dryad Digital Repository
  - <http://dx.doi.org/10.5061/dryad.g6g3h>

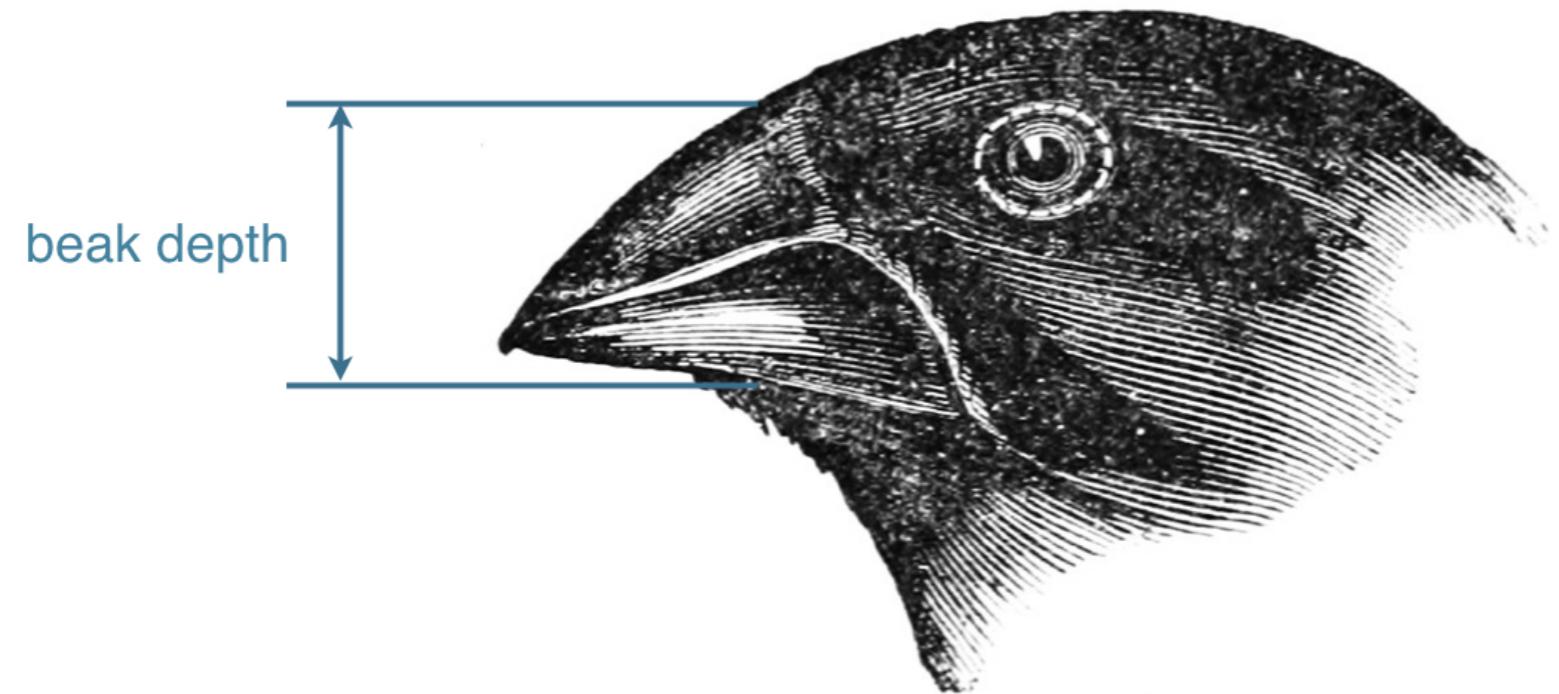


# The dimensions of the finch beak



<sup>1</sup> Source: John Gould, public domain

# The dimensions of the finch beak



<sup>1</sup> Source: John Gould, public domain

# Investigation of *G. scandens* beak depth

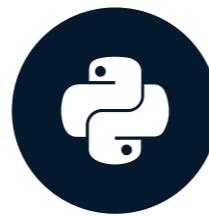
- EDA of beak depths in 1975 and 2012
- Parameter estimates of mean beak depth
- Hypothesis test: did the beaks get deeper?

# **Let's practice!**

**STATISTICAL THINKING IN PYTHON (PART 2)**

# Variation in beak shapes

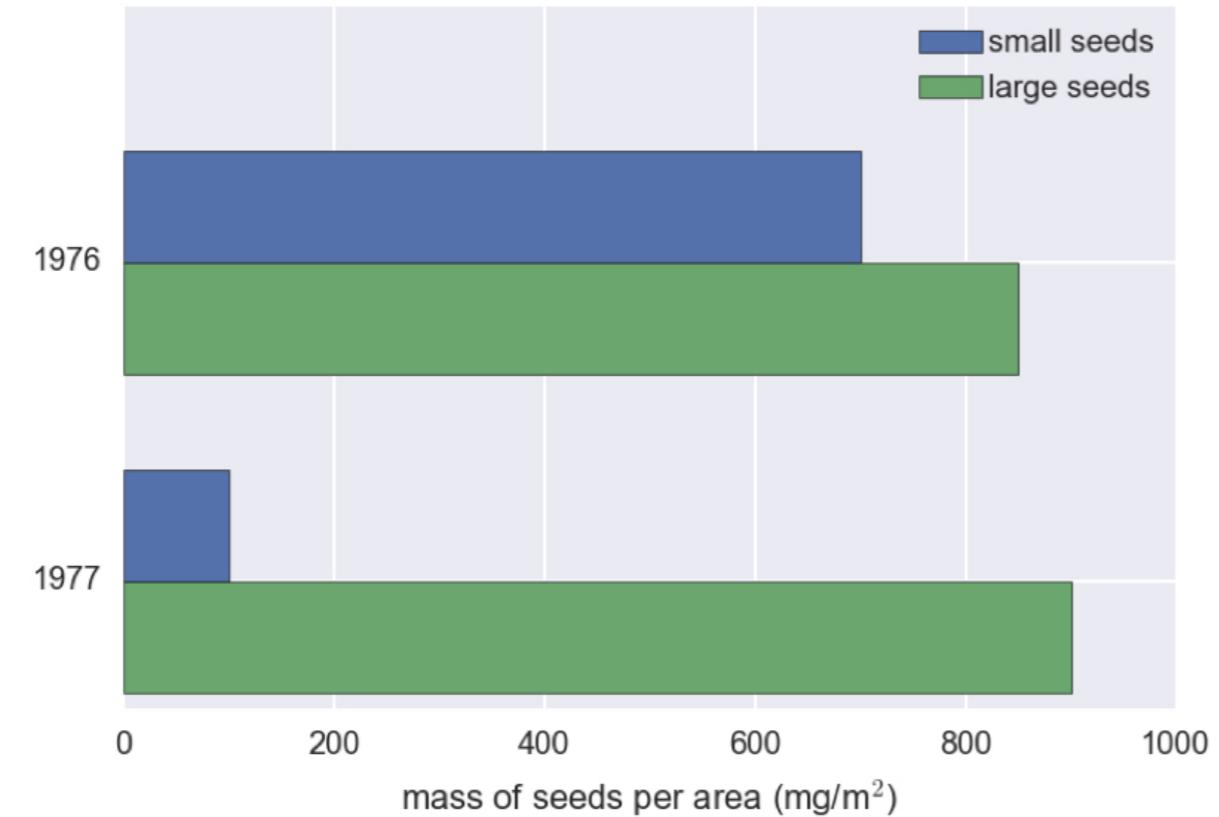
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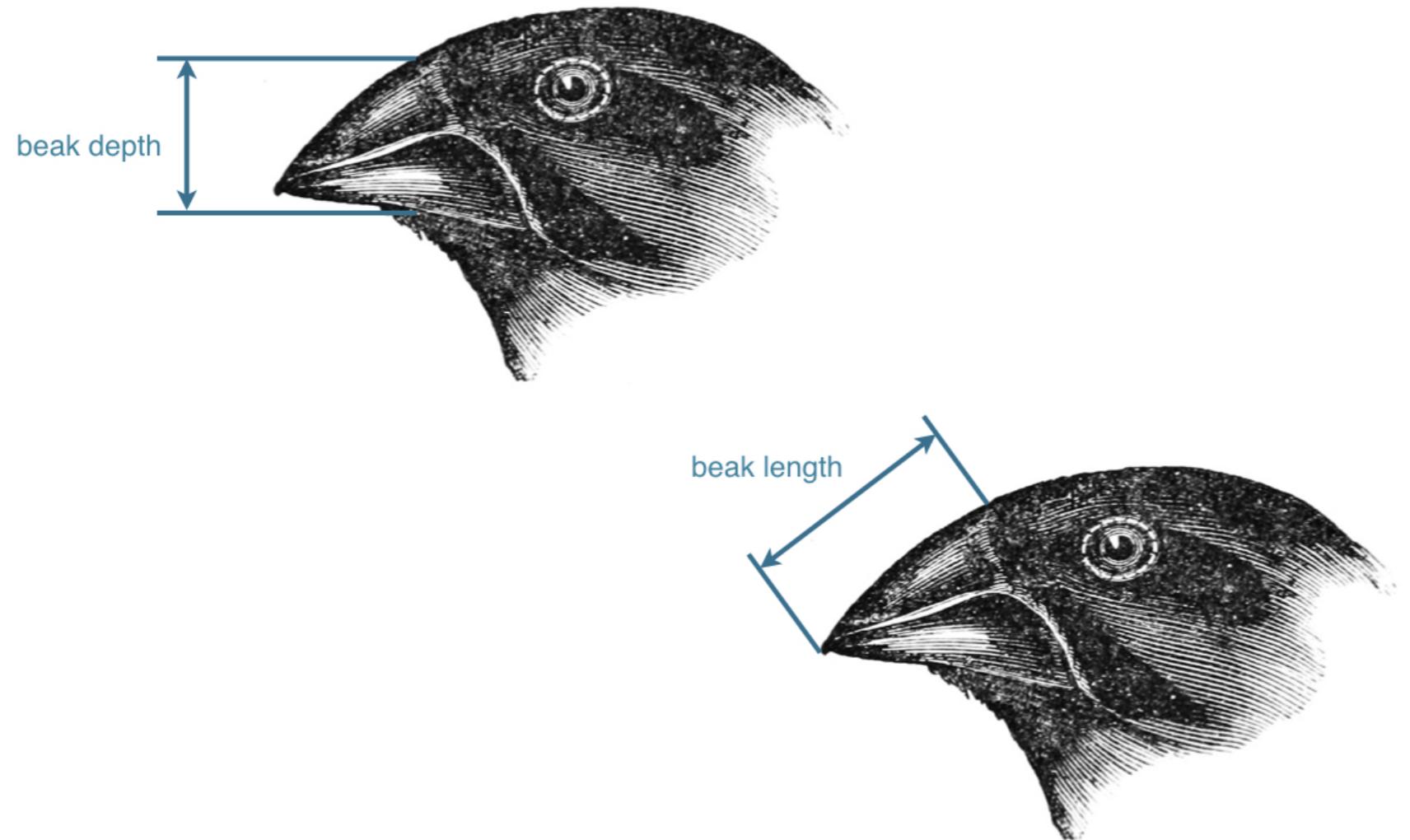
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# The drought of winter 1976/1977



<sup>1</sup> Source: Grant and Grant, 2014

# Beak geometry



<sup>1</sup> Source: John Gould, public domain

# Hint

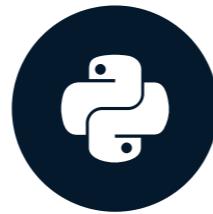
- `draw_bs_pairs_linreg()` will come in handy

# **Let's practice!**

**STATISTICAL THINKING IN PYTHON (PART 2)**

# Calculation of heritability

STATISTICAL THINKING IN PYTHON (PART 2)



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# The finches of Daphne Major



*Geospiza fortis*



*Geospiza scandens*

<sup>1</sup> Source: John Gould, public domain

# Heredity

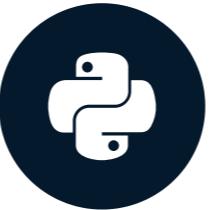
- The tendency for parental traits to be inherited by offspring

# **Let's practice!**

**STATISTICAL THINKING IN PYTHON (PART 2)**

# Final thoughts

STATISTICAL THINKING IN PYTHON (PART 2)



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# Your statistical thinking skills

- Perform EDA
  - Generate effective plots like ECDFs
  - Compute summary statistics
- Estimate parameters
  - By optimization, including linear regression
  - Determine confidence intervals
- Formulate and test hypotheses

# **Let's practice!**

**STATISTICAL THINKING IN PYTHON (PART 2)**