Wildlife telemetry and real-time data analysis

A summary of the current state of consumer available technologies and recent innovations

John Grant, Sigma Eight Inc.
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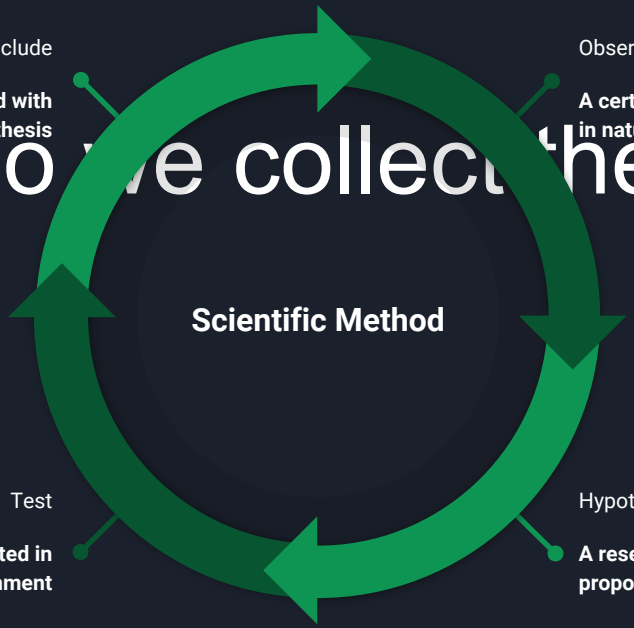
How do we collect the data?



Observe

A certain behaviour is seen in nature or in a subject

Hypothesize

A research asks ‘why?’, and proposes an explanation

Test

The hypothesis is tested in a controlled environment

Conclude

Results are compared with the hypothesis

Current Tracking Technologies

GPS

Cost: $$$

+ High accuracy location
+ Precise timestamps
- Usually combined with a transmitter for retrieval
- High power consumption
- Not available in < 1g

Acoustic

Cost: $$

+ Salt/fresh water
+ < 1g sizes
+ 3D locations
+ No antenna
- Diving often involved
- Hard to automate
- Poor in turbulent water
- Cannot track by land/air
- Aquatic animals only

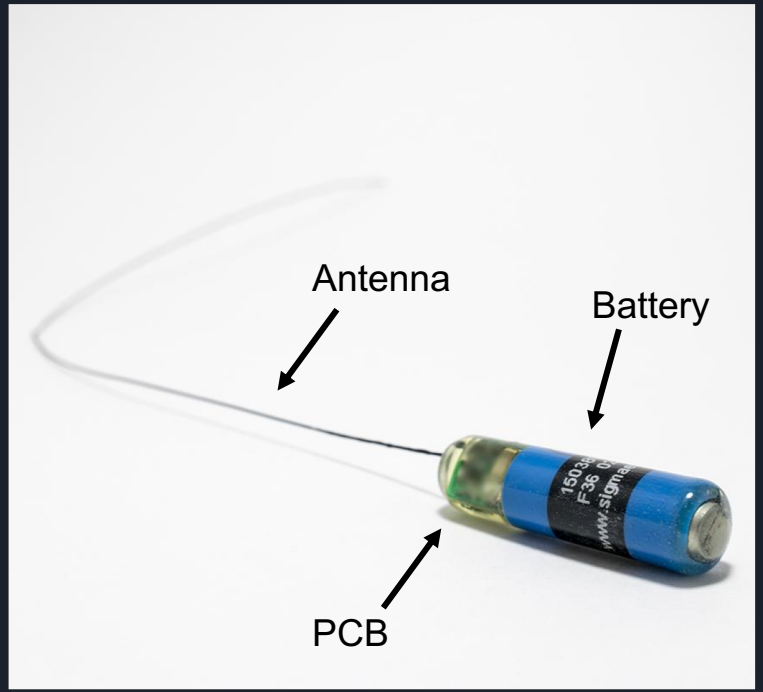
VHF (Radio)

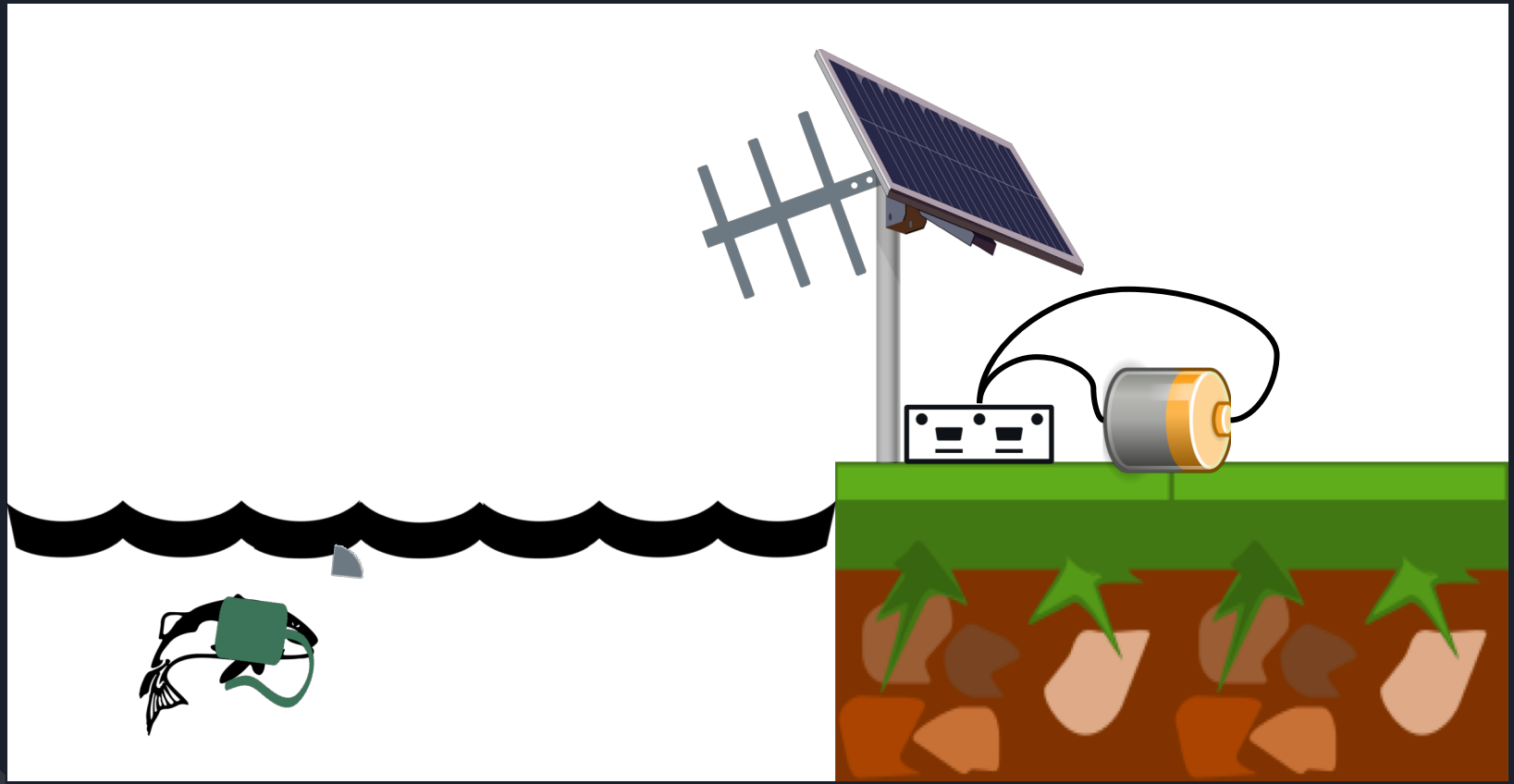
Cost: $

+ Freshwater/land
+ < 1g sizes
+ Low resolution locations
+ Easy-moderate to setup
+ Easy-moderate to automate
- Antenna
- Poor in deep or conductive water
- No high resolution locations

VHF Transmitter

- Consists of 3 basic parts
- Emits a signal on some time interval
- Emits on a specific frequency

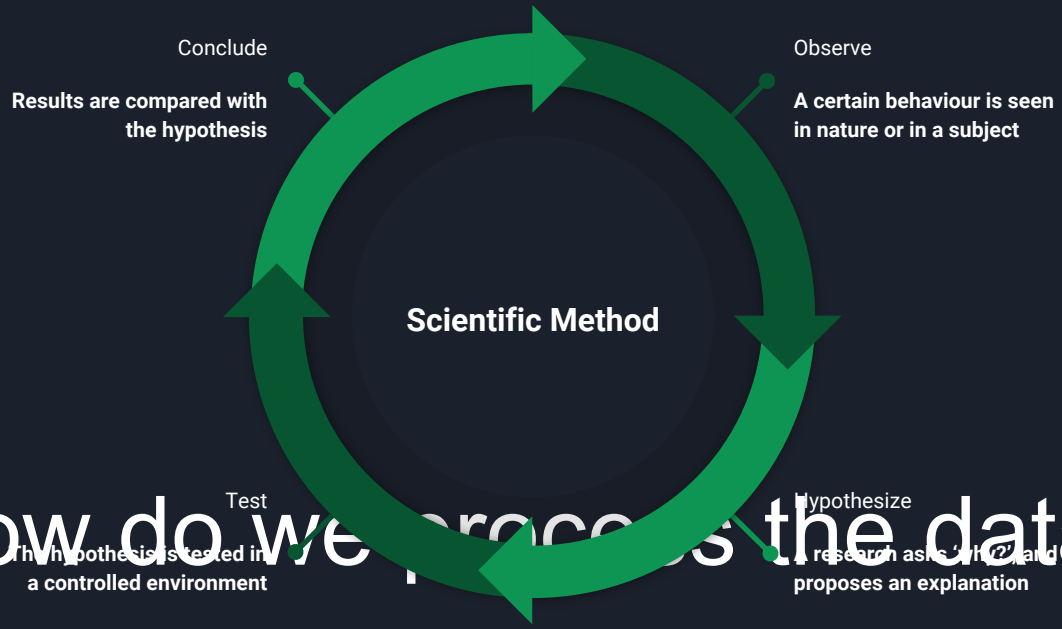




Data Characteristics

Example Row

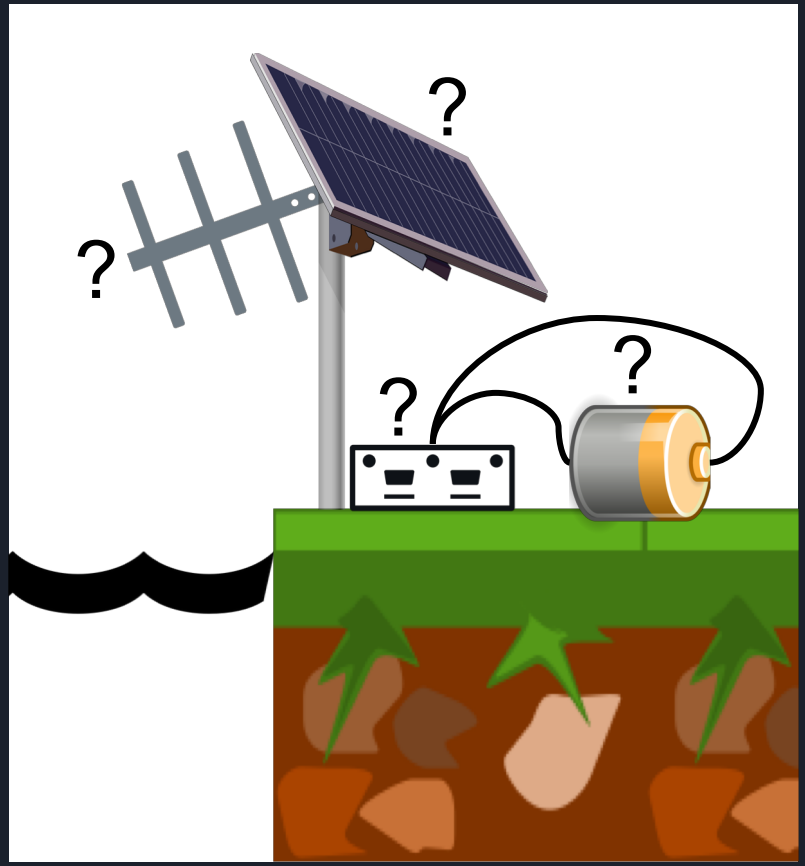
Timestamp	Receiver ID	Antenna	Frequency	Type	Code	Power (dBm)
2018-12-02 10:12:27	4	1	150.560	BEEPER	1002	-94
...	...	...	...	...	...	...



How do we process the data?

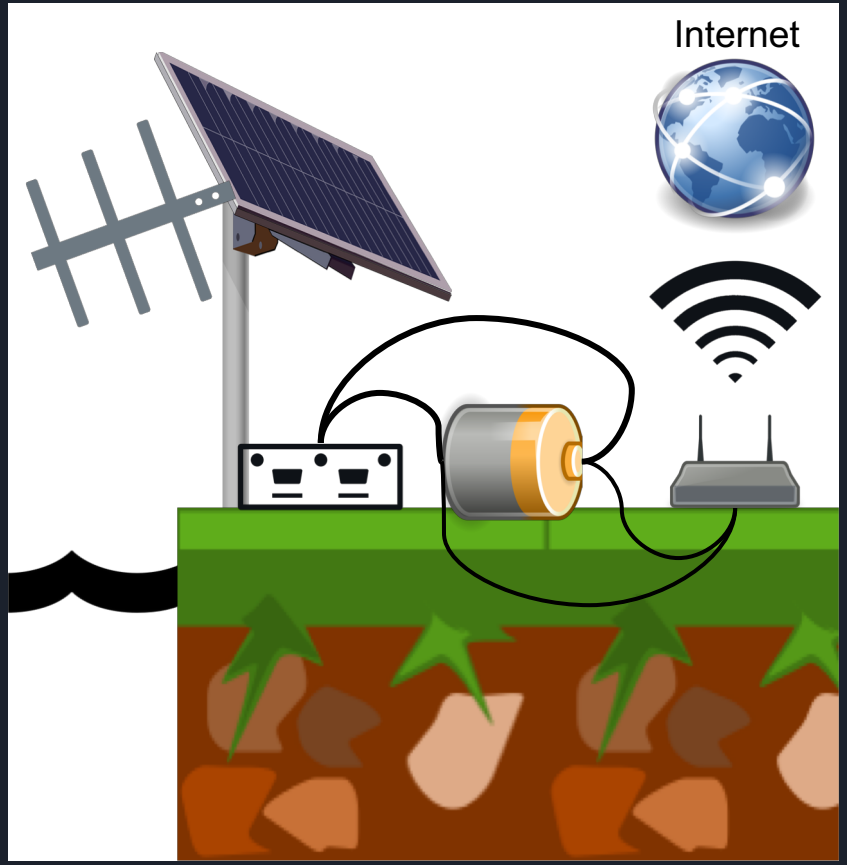
Current Techniques

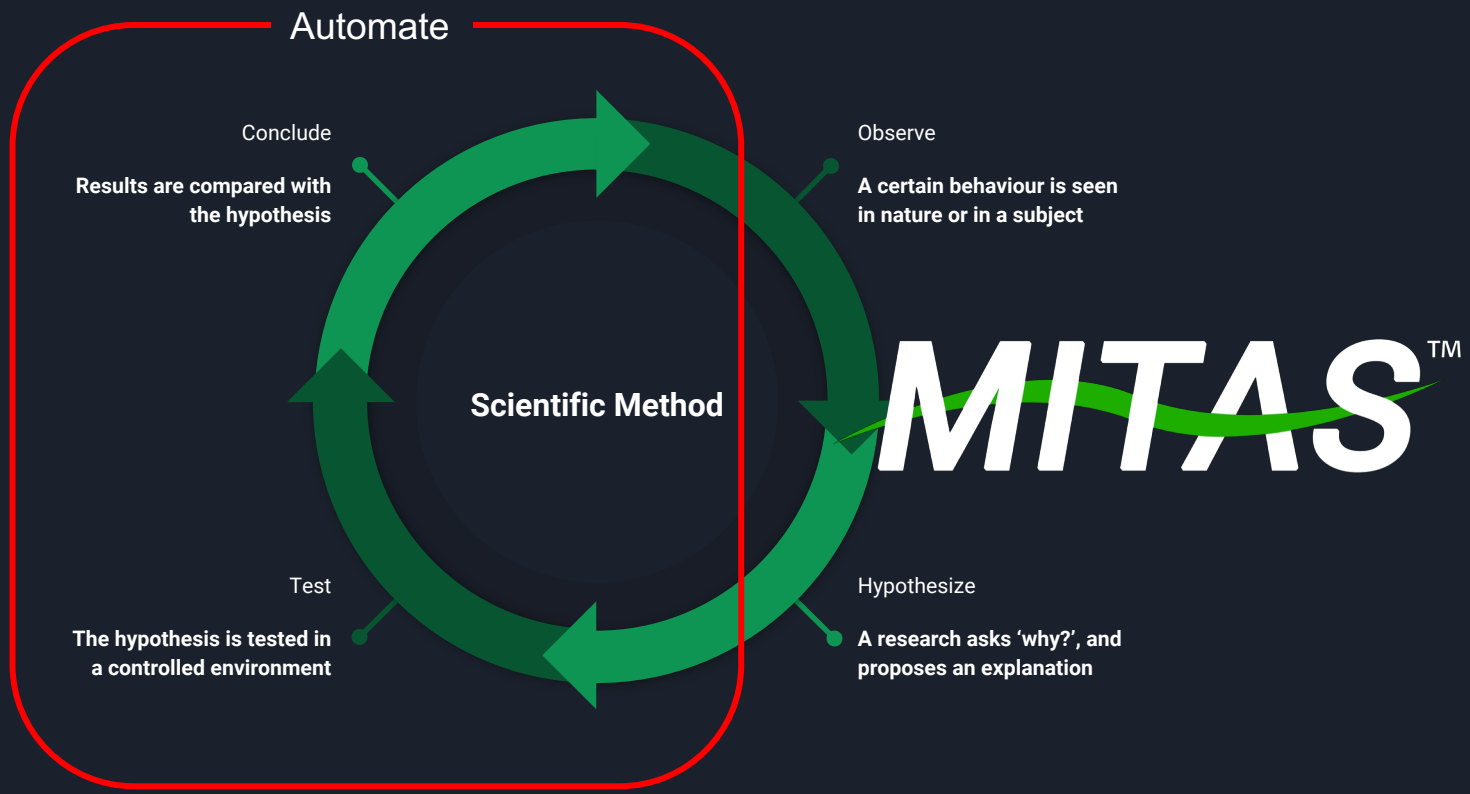
- Data is often gathered manually
- Sites visited occasionally → potential for long dropouts
- Sites visited often → can be expensive
- Data wrangle in spreadsheets, databases, or with R scripts
- Scrutinize the data



Solution:
The internet!

- Put receiver online
- Respond to dropouts as required, instead of a set timeline
- Centralize the database for all receivers



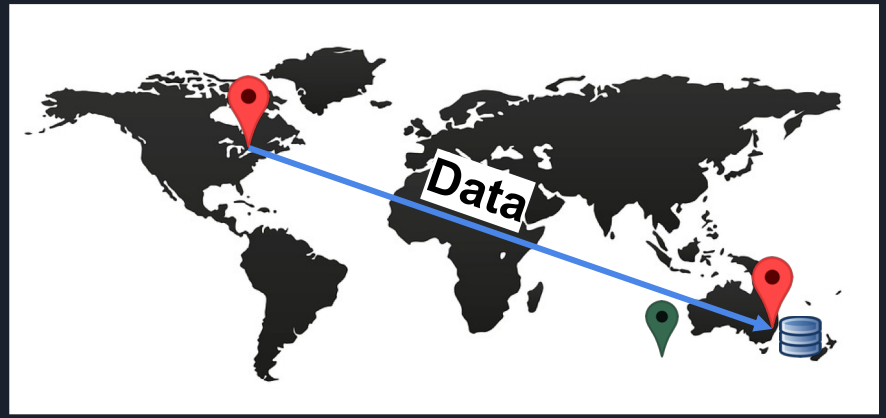

Automate
Conclude
Results are compared with the hypothesis
Observe
A certain behaviour is seen in nature or in a subject
Scientific Method
MITAS™
Test
The hypothesis is tested in a controlled environment
Hypothesize
A research asks 'why?', and proposes an explanation

Can MITAS efficiently transmit receiver data over the internet?

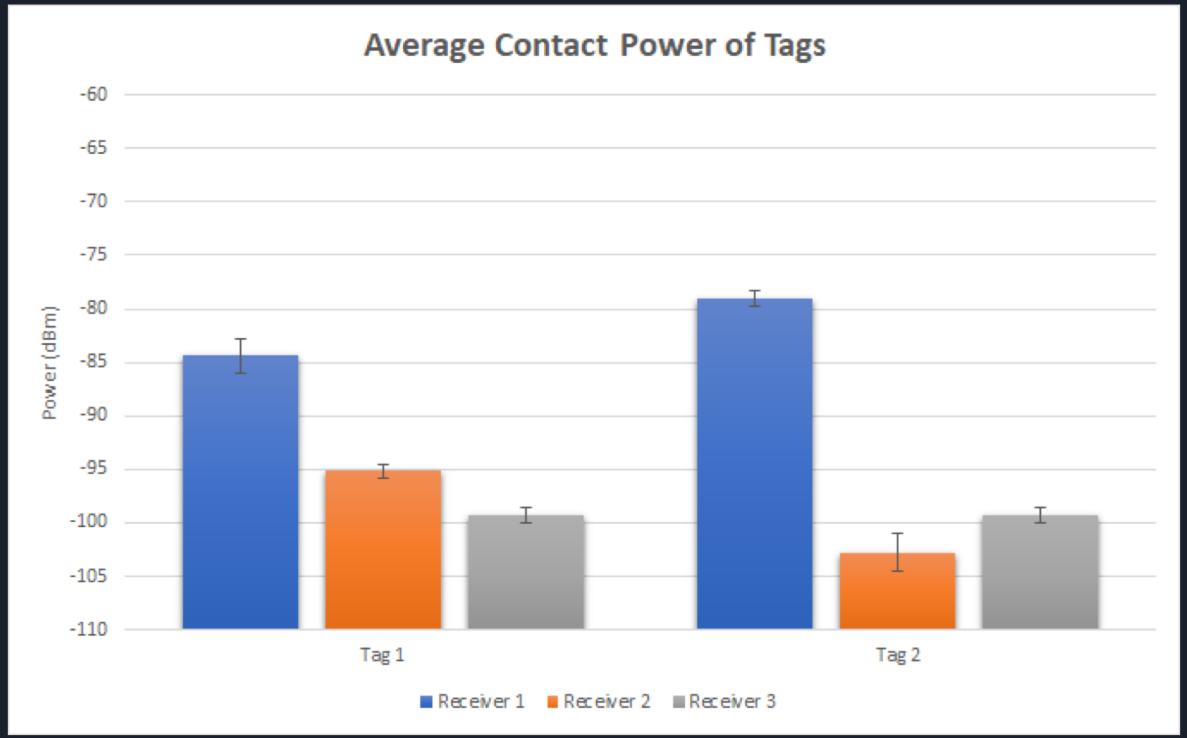
MITAS Experiment

Procedure:

- 3 receivers were setup in our office in Aurora, Ontario, Canada
- 2 transmitters was placed nearby, emitting every 1.1s at a moderate signal strength
- A database server was setup in Sydney Australia
- Experiment was run for 1 week



Results



Each transmitters average contact power grouped by receiver over the 1 week experiment.

99.81 ± 0.04%

Transmission efficiency

Results Explained

Factors for data loss:

- Random network outages
- Power outages
- Strong bursts of noise

Remedies:

- Have wired connections when possible
- Ensure there is a backup source of power, and/or voltage monitors
- Pick frequencies that are not busy

MITAS™

Demo

Next Steps

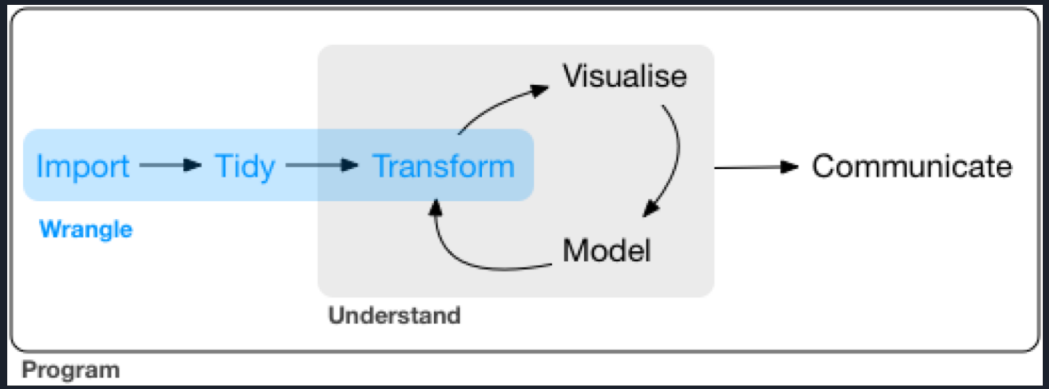
- Ability to add tags
  - Sort data by weight, age, gender, size…
  - Emails/notifications when a tag is present at receiver
  - Migration paths
- Daily reports
  - Detection rates of beacons
  - Status reports on receivers
- Share data
  - Add other researchers to your project with certain permissions
  - Publicize data

All the data generated in this experiment is open source

https://github.com/SEI-John/MitasEfficiencyExperiment

Questions?

Data Wrangling



Grolemund, G., & Wickham, H. (n.d.). Retrieved November 27, 2018, from https://r4ds.had.co.nz/wrangle-intro.html