Quantifying the characteristics of a racing greyhound
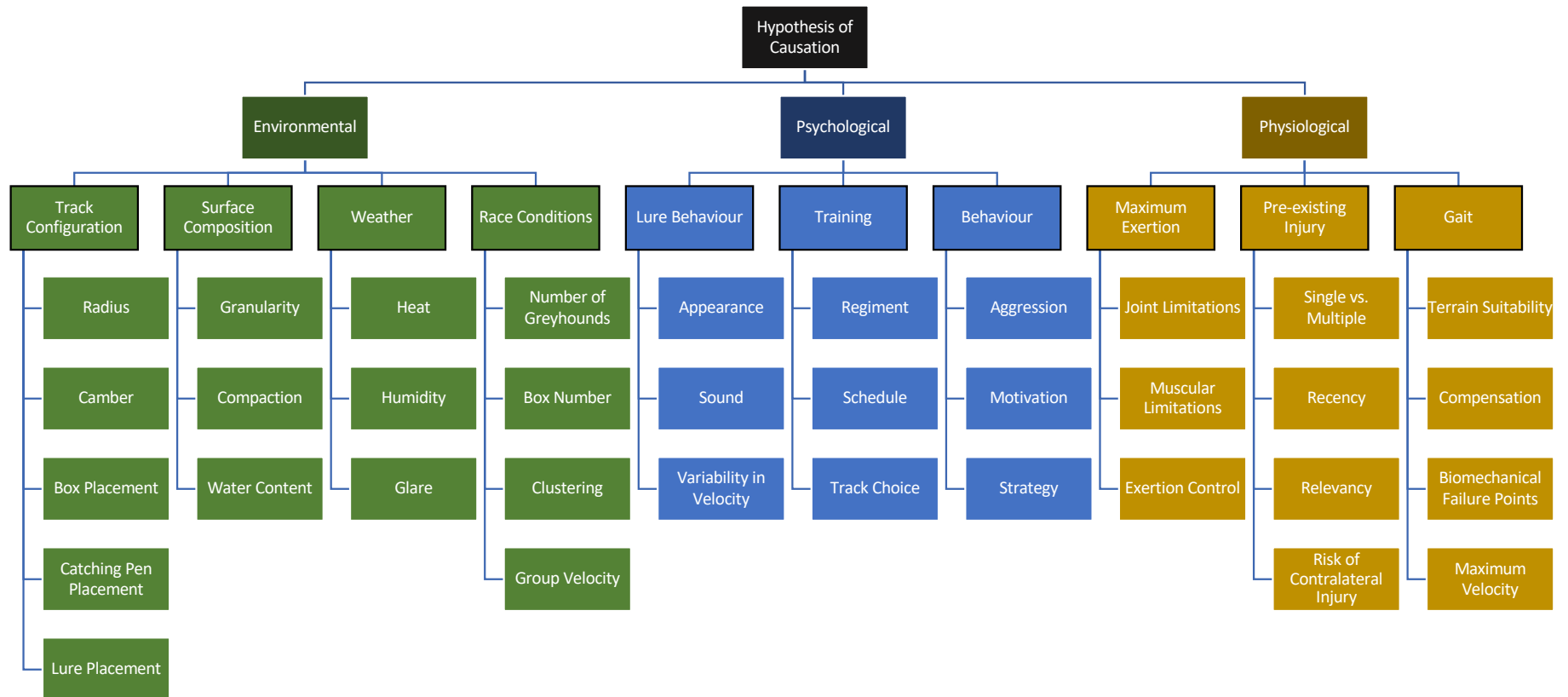
Prof David Eager

Objectives

- To understand the mechanisms behind racing incidents; their origins and effects

- To identify the critical conditions leading up to an incident

- To determine if and how correlated factors can be exploited to maximise injury prevention
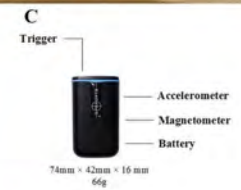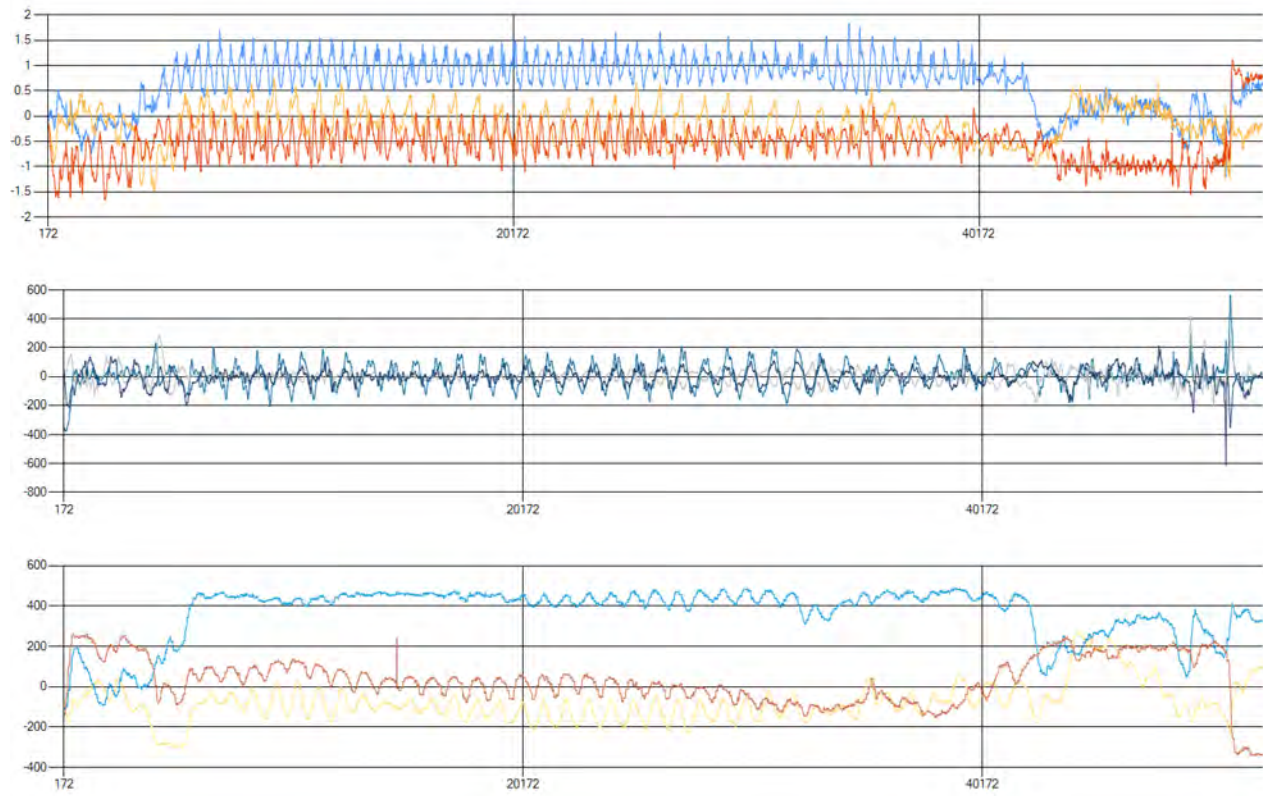
Questions

- Why do perfectly healthy greyhounds fall seemingly without provocation?
- What factors influence the severity of injury?
- What environmental or physiological factors cause greyhounds to cluster? How do each of these factors compare? How can we mitigate these factors?
- How does track design impact performance characteristics? Are we approaching physiological limitations?
- What is the ideal performance zone for minimal injury? Can we adjust this value through design?

Strategy

- Hypothesis of Causation
  - **Environmental**
    - **Track Configuration**
      - Radius
      - Camber
      - Box Placement
      - Catching Pen Placement
      - Lure Placement
    - **Surface Composition**
      - Granularity
      - Compaction
      - Water Content
    - **Weather**
      - Heat
      - Humidity
      - Glare
    - **Race Conditions**
      - Number of Greyhounds
      - Box Number
      - Clustering
      - Group Velocity
  - **Psychological**
    - **Lure Behaviour**
      - Appearance
      - Sound
      - Variability in Velocity
    - **Training**
      - Regiment
      - Schedule
      - Track Choice
    - **Behaviour**
      - Aggression
      - Motivation
      - Strategy
  - **Physiological**
    - **Maximum Exertion**
      - Joint Limitations
      - Muscular Limitations
      - Exertion Control
    - **Pre-existing Injury**
      - Single vs. Multiple
      - Recency
      - Relevancy
      - Risk of Contralateral Injury
    - **Gait**
      - Terrain Suitability
      - Compensation
      - Biomechanical Failure Points
      - Maximum Velocity
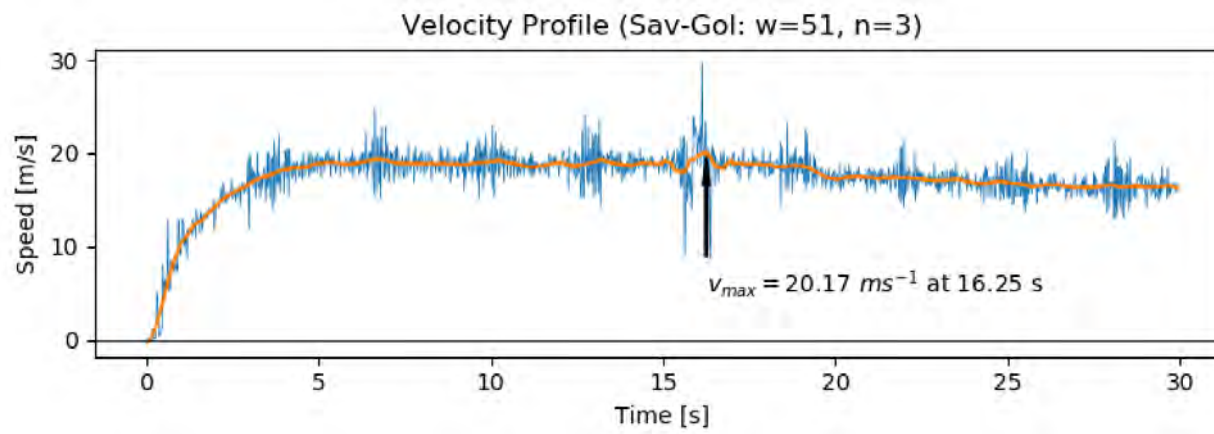
Strategy

- Analyse data from a variety of sources:
  - Injury databases and veterinary reports
  - Inertial measurement devices
  - Tracking devices
  - Racing databases (i.e. FastTrack)
  - Survey plans
  - Architecture drawings
  - High Frame Rate cameras (HFR)
  - Drones
  - Race footage (i.e. Sky)
  - Surface samples
  - Maintenance schedules
  - Intervention schedules
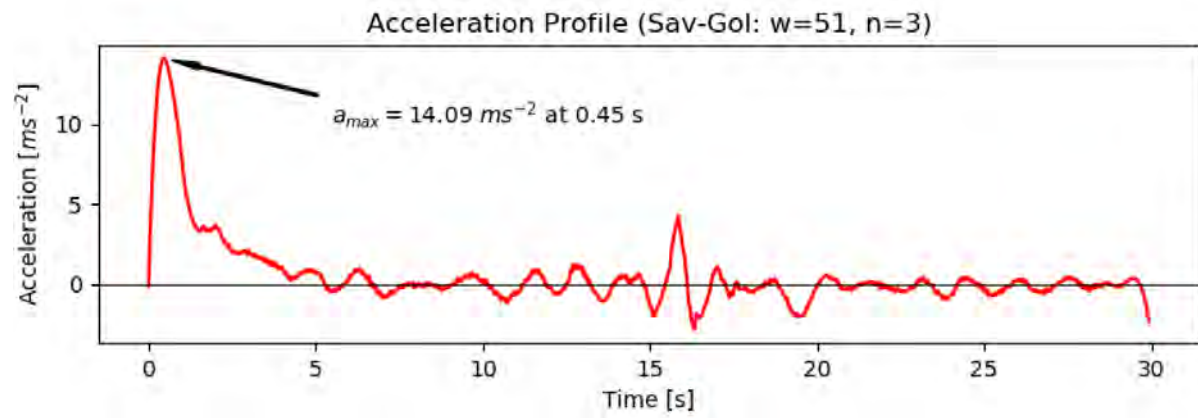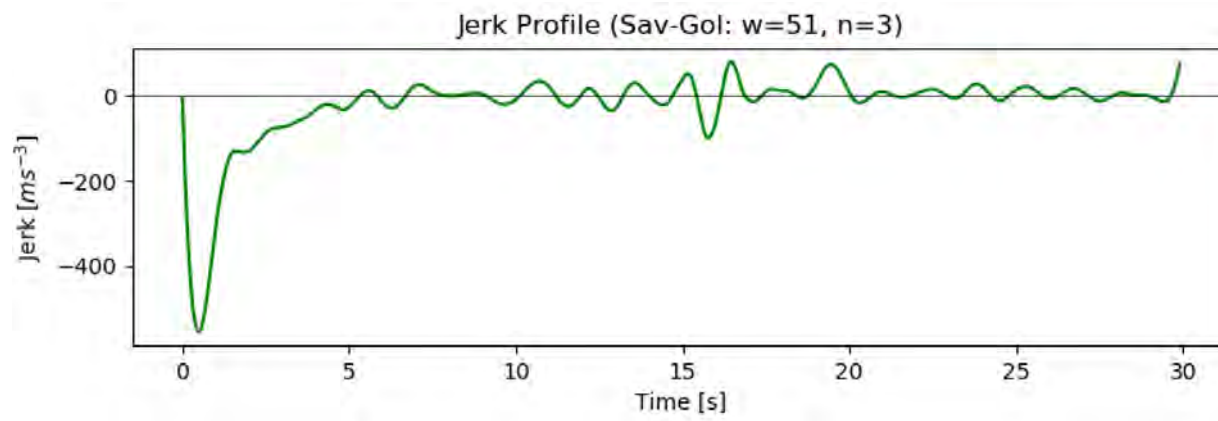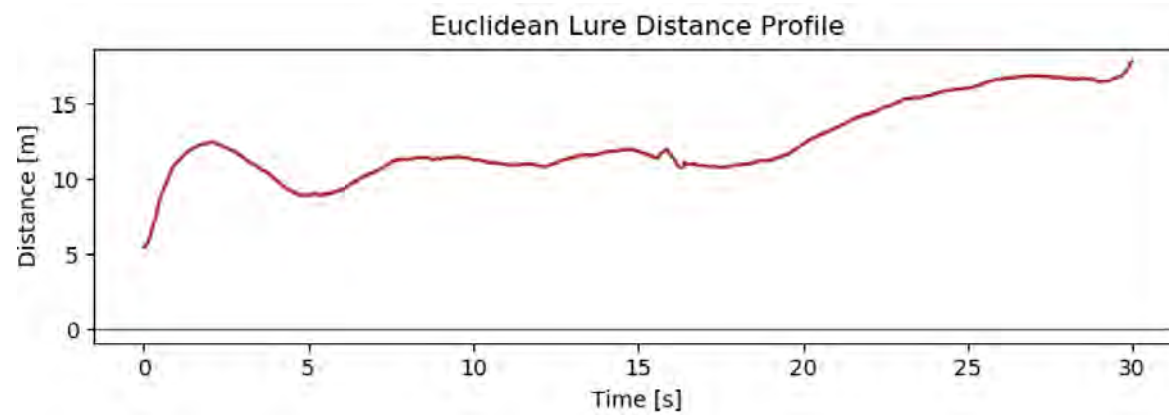 - Computer-generated simulations and kinematic models

Strategy

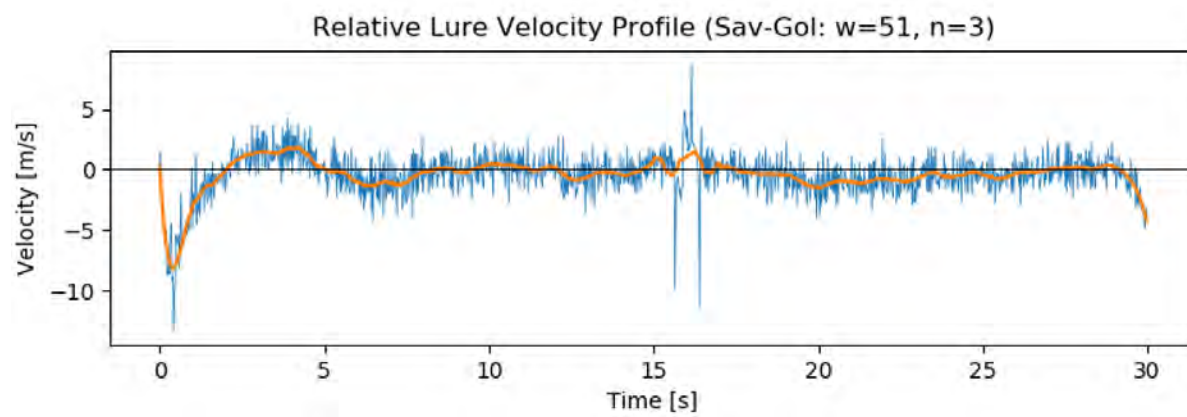|	Injury Data	Racing Data	Tracking Data	Kinematic Data	Bio-mechanical Data	Survey Data	Intervention Data	Surface Data	Simulation Data
Lure Studies	X		X	X	X		X		X
Preferential Box Draw	X	X	X	X					
Traralgon Design	X			X		X			X
Sand Analysis	X							X	
Bend Analysis	X			X		X			X
etc.	-	-	-	-	-	-	-	-	-

Characteristics

First preview

Velocity Profile (Sav-Gol: w=51, n=3)

$v_{max} = 20.17\ ms^{-1}$ at 16.25 s

Acceleration Profile (Sav-Gol: w=51, n=3)

$a_{max} = 14.09\ ms^{-2}$ at 0.45 s

Jerk Profile (Sav-Gol: w=51, n=3)

Euclidean Lure Distance Profile

Relative Lure Velocity Profile (Sav-Gol: w=51, n=3)

Perpendicular Rail Distance Profile

$d_{min} = 0.67\ m$ at 24.78 s
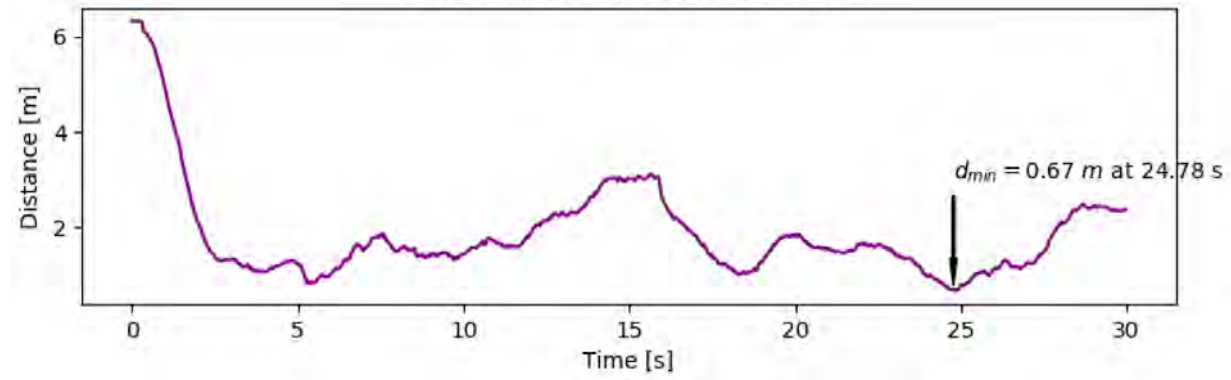
Greyhound Facts

- A greyhound can achieve a maximum velocity of approximately 72km/h; it will reach this velocity within the first 5 seconds

- A greyhound can achieve a peak acceleration of around 14m/s*s

- A 35kg greyhound will experience a 316N centrifugal force around a 40m bend or the equivalent of 32kg of force pulling outwards

- A greyhound will make approximately 3.5-4 strides per second with a 5m stride length

- A greyhound will not hold the same line around the track

- A greyhound will lean into a turn to counteract the centrifugal force

Why do we need to quantify these values?
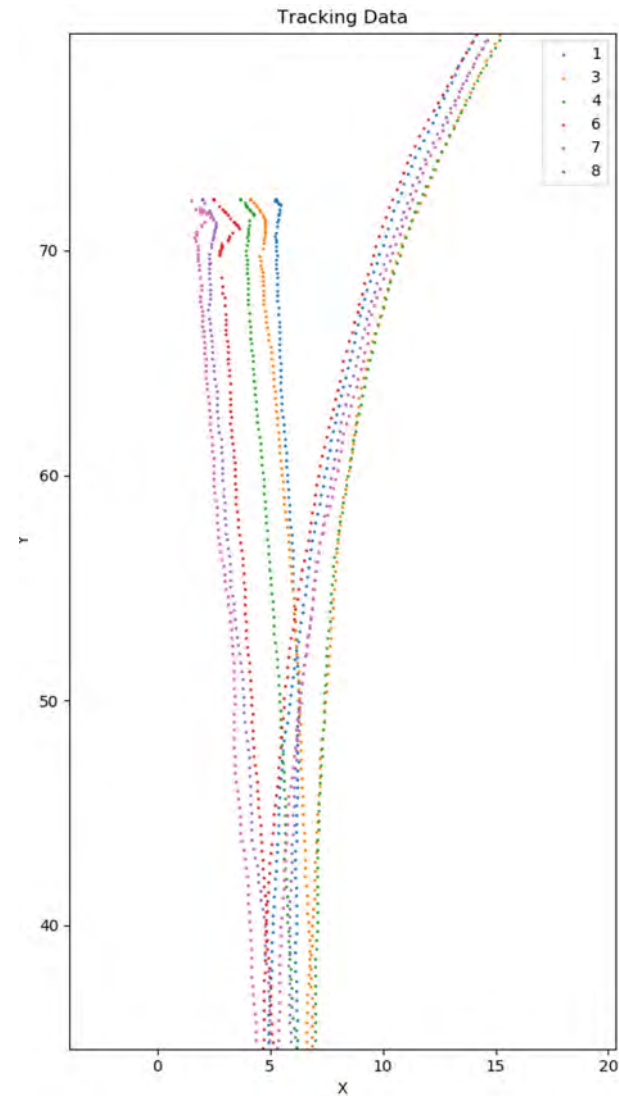
Lure Intervention

Case Scenario

Variables

Race Performance
- Height
- Length
- Colour
- Sound
- Modules
- Appendages
- Swinging vs. Fixed
- Hoop vs. Straight
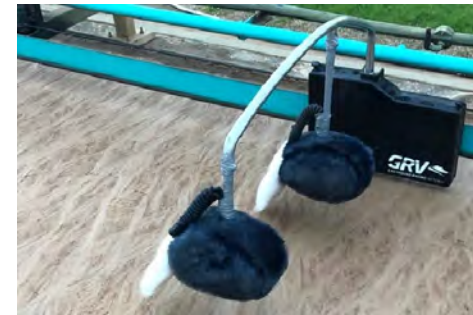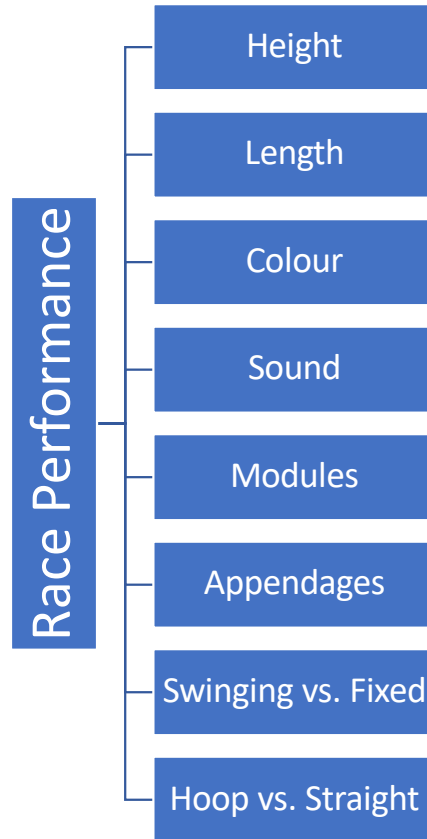
Metrics

- Race performance
  - Group length
  - Cluster factor
  - Object proximity
  - Lure distance
  - Engagement delay
  - Interference
  - Rail distance
  - Trajectory stability
 - Failing to chase
  - Marring

Tracking Data

Statistics

- A statistically significant sample size must be collected for an analysis to have any sort of meaning
  - This applies both to number of unique greyhounds involved in a study and the total number of starts
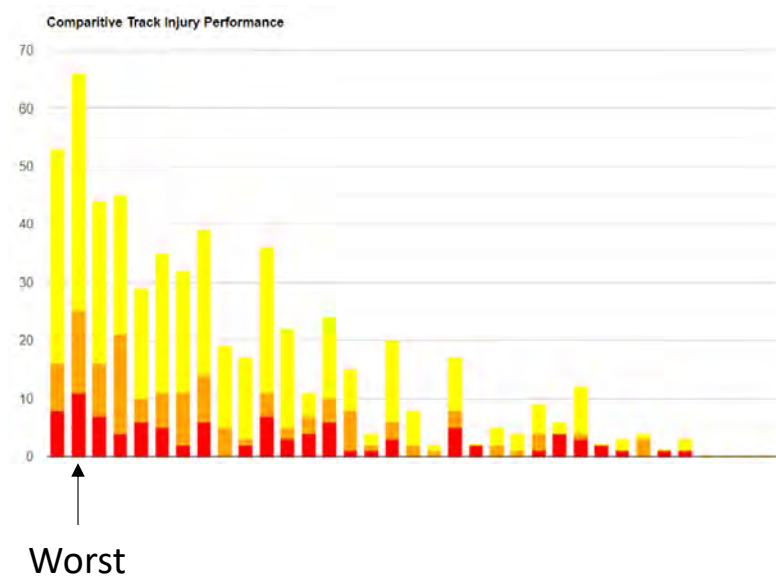
Statistics
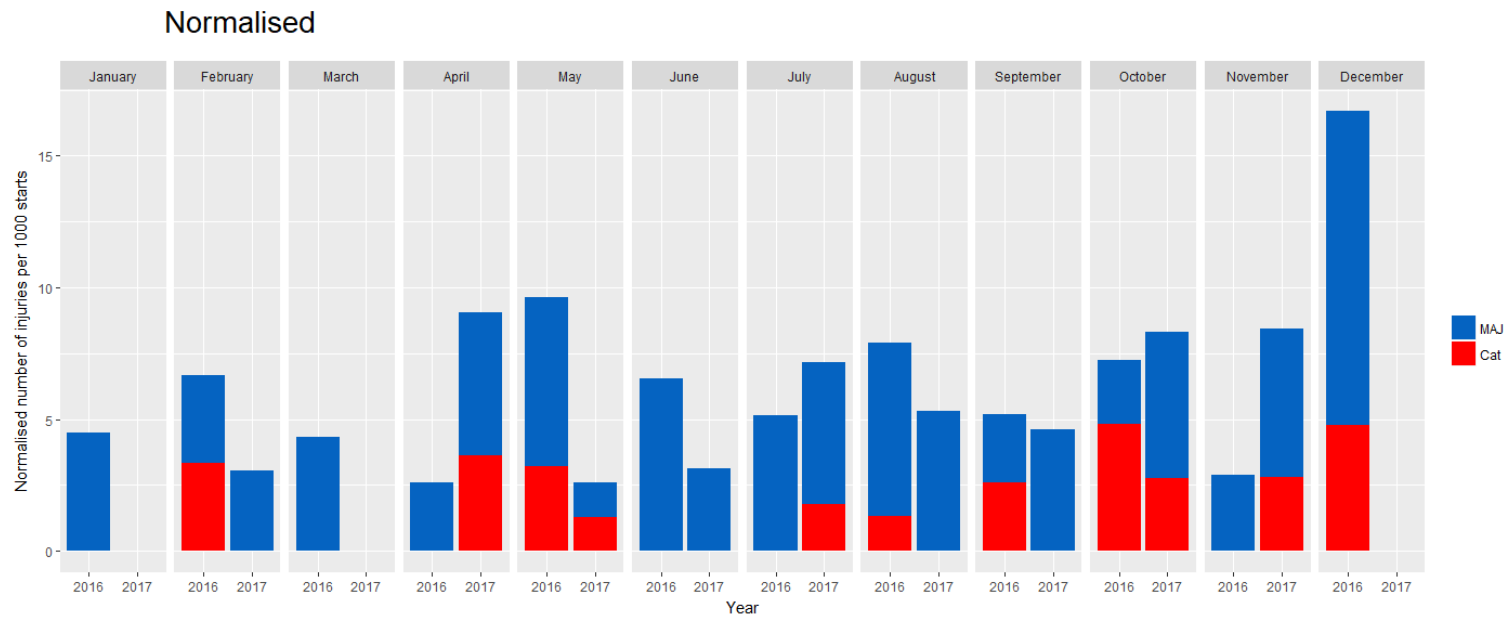
- Why is statistical significance important?

1 Month

Better then average

1 Year

Worst

Statistics

Normalised
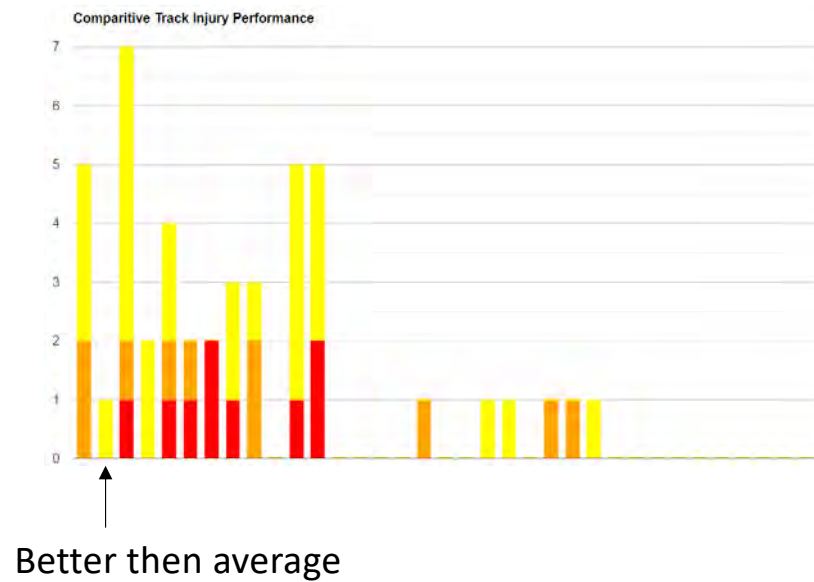
Statistics

- An intervention study, for example, requires at least 12 months of data preceding and proceeding the intervention

- It is impossible (and even dangerous) to draw conclusions from an inadequate sample size

- Correlation DOES NOT imply causation (i.e. just because two events happen simultaneously does not mean they are linked)

- All possible metrics must be analysed