# Risk-based Triggering of Bio-inspired Self-Preservation to Protect Robots from Threats

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## Aim

Asses animal behaviour when under threat from prey and apply the same principles to delivery robots with a particular focus on flight initiation distance and how animals calculate when the cost of remaining outweighs the cost of fleeing

## Objectives

- Establish the most biologically sound methods of escape from pursuit via a literature review.
- Create, simulate and test a proposal for feasible anti-vandalism or damage preventive safety mechanisms, that complement and preserve human safety.

## State of the Art

- Previous project found the best self-defense strategy for a ground-based delivery robot is fleeing and hiding
- Generally agreed that animals tend to flee when the risk of remaining is greater than its benefits
- Animals calculate an ideal flight initiation distance based on the level of risk they face

## Methods and Tools

- Building and Testing platform: Morse
  Main tools:
- Flying Cat and Mouse Game
- Proximity Sensor, Battery Sensor, Motion Sensor
- “Outdoor” Blender world


When would a robot need to activate self-defense mechanisms?

- Based on a scenario where a malintentioned cautious drone is pursuing a ground based drone.
- Drone attempting to steal entire robot including contents

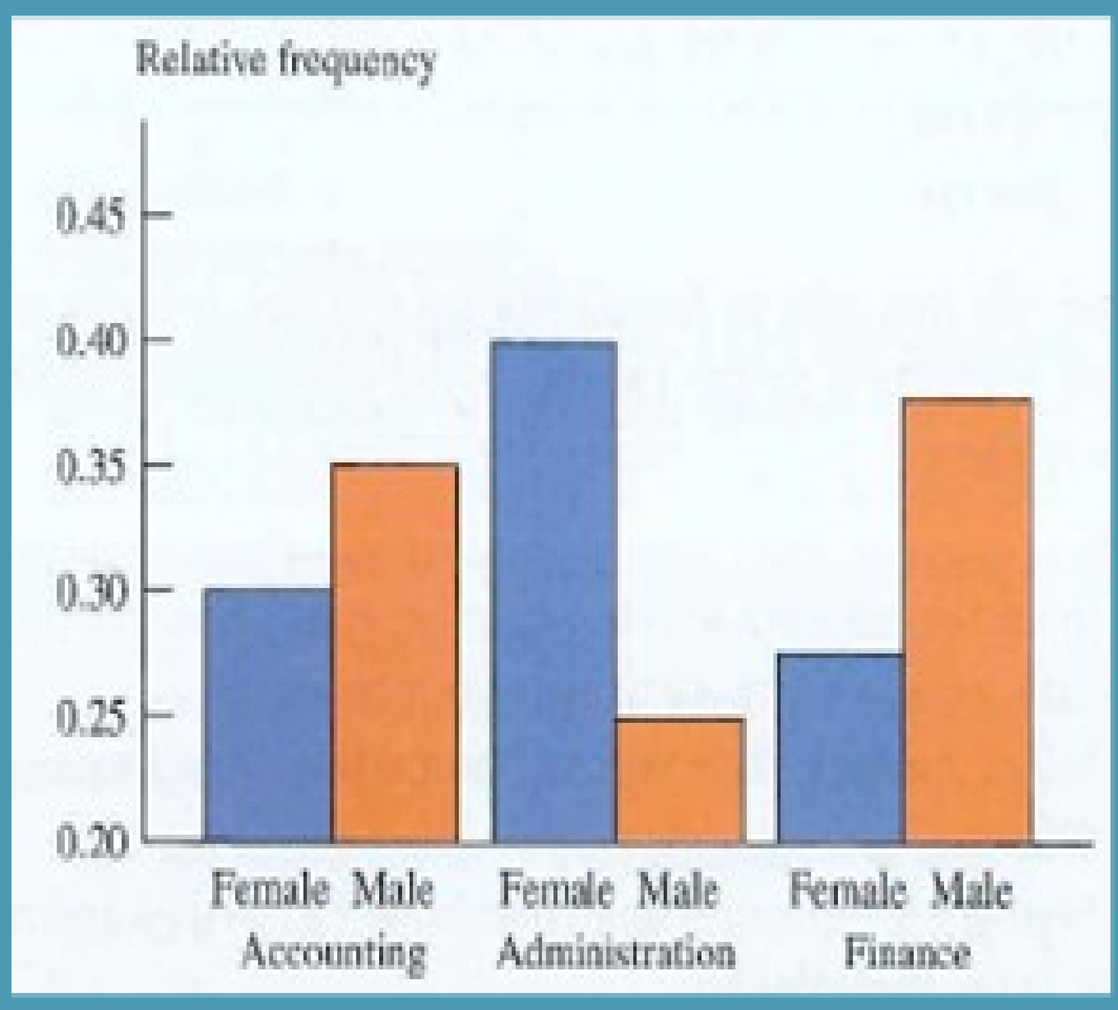
How can a robot accurately imitate biological anti-predator behaviours?

- Key traits involve accurately assessing risk
- Robot must be able to determine when continuing with its task is higher
- risk than fleeing, based on its priorities

How will the scenarios be deployed?

- Two robots; one focused on task-completion and not consuming too much energy; one focused on survival with no regard for energy
- Robots will be given reaction of fleeing and hiding when self-defense mechanisms are activated
- When drone is within 10cm of the robot it will be counted as a capture

## Results




## Future Work

Introduce element of machine learning so robot does not need to be hardcoded with responses – especially with a fleet of robots

Replicate these tests in a series of different environments with different obstacles and start and end points

Carry out similar testing on physical robots to ensure simulated environmen does not affect results

Examine self-defense mechanisms when robots face other threats, e.g.tampering animals or children

## Conclusions

- EXAMPLE CONCLUSIONS:
- Robots who are more focused on battery saving/ safety tend to be more successful in avoiding the drone
- Robots who are more focused on battery saving/ safety tend to conserve more energy by the end of the encounter
- Robots who are more focused on battery saving/ safety tend to complete their mission more quickly
- It is necessary for a robot to be balanced in terms of its priorities in order to have the best chance of completing its task and surviving a predatory encounter/ x clearly performed much better in these tasks which would suggest a focus on x is preferable when designing robots

## References

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