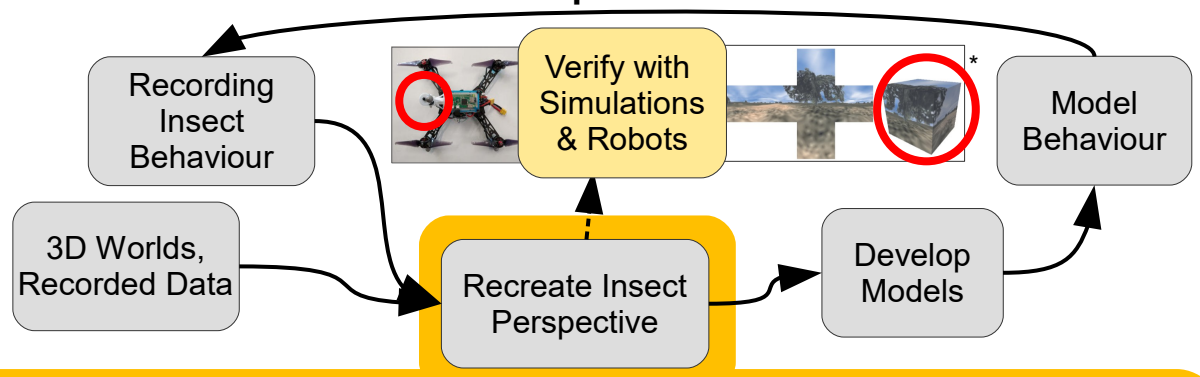
Toward Insect Inspired Visual Sensors for Robots

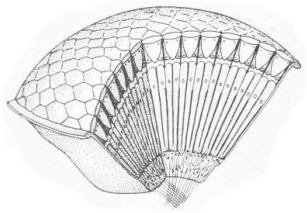
Blayze Millward, Steve Maddock & Michael Mangan

From Insects to Micro-UAVs

- Micro-scale robotics, in particular micro-UAVs, require lightweight, lower-power sensors that are yet to be designed
- Insects provide a fantastic proof of concept for lightweight autonomous visual navigation, prompting investigation
- Insect visual navigation research has been limited by a lack of faithful reproduction of the insect perspective

The Bio-Robotic Research Loop





The Compound Eye, consisting of thousands of lenses †

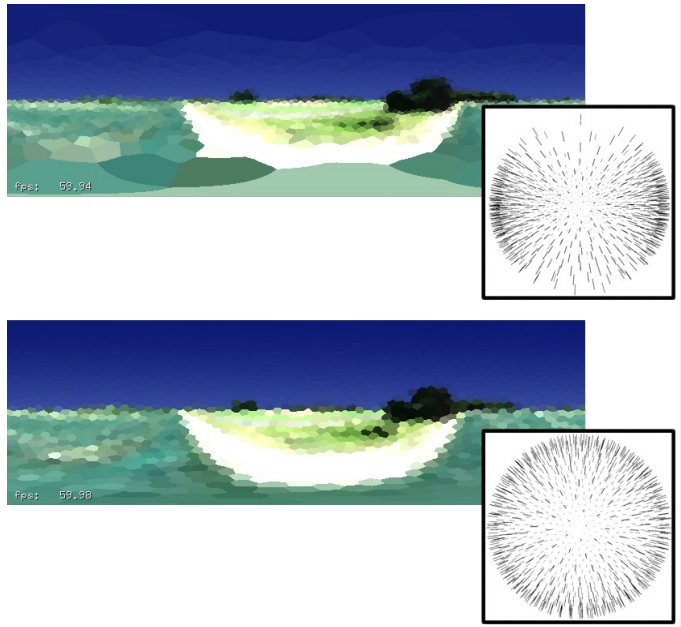
A traditional camera, with only one focal point

The Problem

- To inform compound eye inspired sensor design, an eye must be simulated
- This requires the faithful simulation of thousands of optical systems
- And must be achieved in *real time or faster* to allow design-space search
- Historical works have been *fast, but inaccurate* or *accurate, but slow*

The Solution

- Recent improvements in graphics processing hardware has allowed for real time application of *ray tracing*
- Ray-based techniques align perfectly with simulation of the insect compound eye
- This allows for search of the design-space of the compound eye
- Leading to application-specific visual sensors



Acknowledgements

Images found or adapted from those found in:

† "Animal Eyes", M F Land & D-E Nilsson (2004)

* "Modeling Insect Compound Eyes: Space-Variant Spherical Vision", T R Neumann (2002)

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The University Of Sheffield.