Is Binocular Vision Involved in Trajectory Control in the Praying Mantis Strike?

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Introduction

Figure 1

Binocular allows an animal to use both eyes to detect prey[1,2] Using this a mantis can work out:

- The speed of the prey
- If the prey is in the mantis' striking range
- The expected trajectory of the prey[3]

First the mantis turns its head so that the prey is in the middle of both eyes, then it turns its body ready for the strike[2].

But is this body turn controlled by binocular vision or is one eye or even the side 'lateral' vision of the eye enough for this? To aid understanding of mantis vision, I used barriers to cover either one eye or the middle regions of both eyes to see:

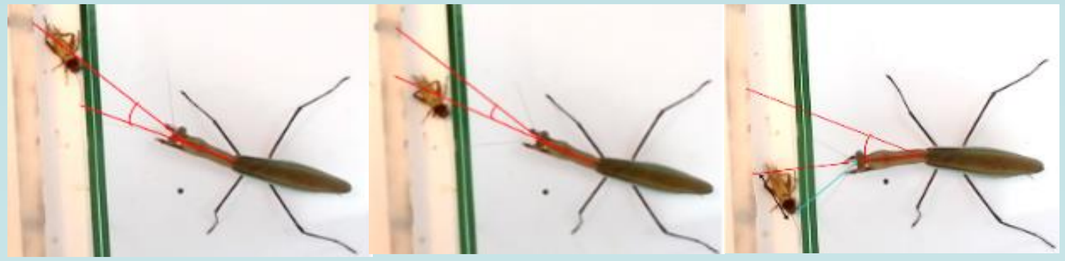
a) If this affects the body turn angle that brings the prey into the middle of the eye

b) If it stops prey position prediction

Methods

- Mantids *(Tenodera aridifola)* were placed into a perspex arena with a cricket on the other side of a thin glass barrier.
- A video camera directly above the mantis recorded behaviour of both prey and predator and the strike action.
- One eye was covered using thread and sticky weed attached to the forehead by beeswax.
- Middle of both eyes covered in same way as in Figure 1.
- Speed of prey was noted and measurements obtained from video as seen in Figure 2.

Results



1- Head to thorax angle 2- Last head turn angle 3- Last body turn angle. (⟶) Prey position prediction to actual prey position. (⟶) Distance from mantis to cricket head at strike

Figure 2. Stages of mantis strike and measurements taken

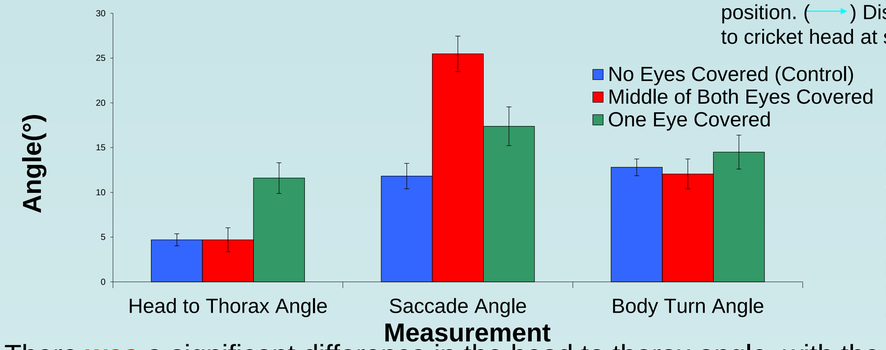


Figure 3. Measurements of body turn angle, head to thorax angle and head turn angle separated by procedure and measured in degrees.

There **was** a significant difference in the head to thorax angle, with the angle higher when one eye was covered than in the control or when the middle of both eyes were covered. There **was** a significant difference in the final head turn angle with the middle of both eyes covered angle the highest.

For body turn angle there were **no** significant differences.

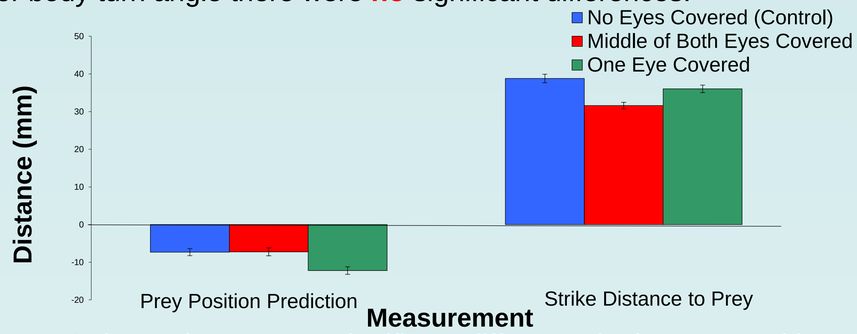


Figure 4. Measurements of distance of the predicted prey position and distance between mantis and prey separated by procedure and measured in millimeters.

Figure 4 shows there **was** a significant difference in the prey position prediction with the projected strike position lower when one eye was covered than both the control or when the middle of both eyes were covered..

For each procedure strike distance was different and showed **a significant difference.**

Discussion

- **The strike distance** differences confirm a lack of depth perception when either one eye or the middle of both eyes was covered.
- When the middle of both eyes were covered, **prey position prediction** was similar to the control suggesting both eyes can still work together.
- **Bigger head turn angle** when the middle of both eyes were covered but similar body turn angle and prey position prediction to the control, suggests side regions of both eyes still work together.
- **Head to thorax angle** is much higher when one eye is covered possibly because the mantis is trying to compensate after losing vision from one eye to get the image into the middle region of this eye
- **As body turn angle** was similar between all of the conditions, body angle is **not controlled** by binocular vision but other aspects of the strike such as the head turn and final position prediction are.
- This data suggests mantids are not good at predicting prey trajectory.

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References

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