Different Eyes but Similar Processing? Visual cognition in the jumping spider

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Introduction

Salticidae is a unique family of spiders that actively hunt their prey instead of creating a web to trap it. This kind of behaviour requires the ability to navigate complex and dynamic environments and, to be able to detect and analyse the relevant stimuli, a highly developed visual system. Starting from existing literature (Jakob et al., J. Arachnology, 2007) we decided to test the visual skills of the species *Phidippus regius*, a spider of this family. With a binary choice paradigm, we investigated the ability to discriminate between two shapes, a square and a triangle, as a starting point for the investigation of more complex skills.

Methods

Subjects

- 36 juvenile (unsexed) spiders were succesfully tested

Apparatus

White plastic T-shaped maze

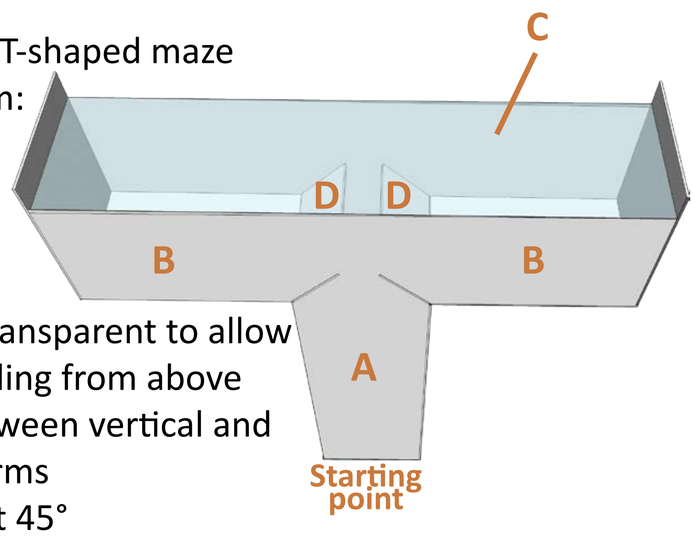
A Vertical arm: 15x5x5cm

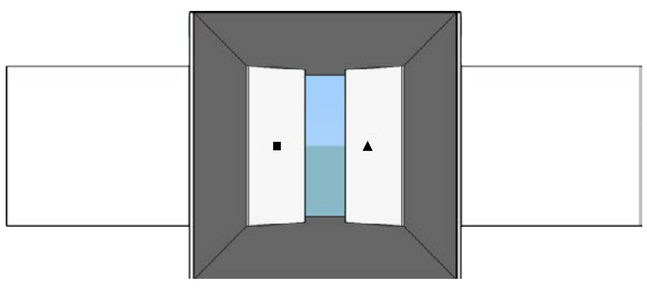
B Horizontal arm: 20x5x5cm

C Top wall: transparent to allow video-recording from above

D 2 walls between vertical and horizontal arms

- Placed at 45°
- 2.5cm long
- shape glued on the centre





- Shapes
  - square vs triangle
  - black colour
  - matched for total area (16mm²)

Procedure

Each spider inserted individually from the bottom of the vertical arm (Starting Point)

Sequence of trials

- 8 training trials (one each day)
  - Prey placed behind wall with reinforced shape
  - Its position (left or right) changed according to semi-random sequence
- Test trial (non-rewarded, one day after the last training trial)
  - Choice in this trial is considered for the analysis
  - After the test trial a prey was presented to assess motivation

Structure of a trial

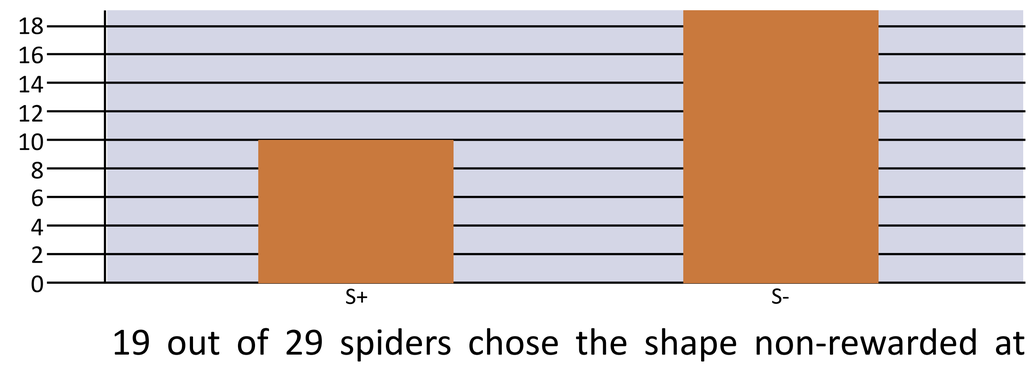
- Habituation time: 5min
- Free to move in the apparatus for 60min

Practical information

- 10 apparata used at once
- Experimenter left the room during all trials

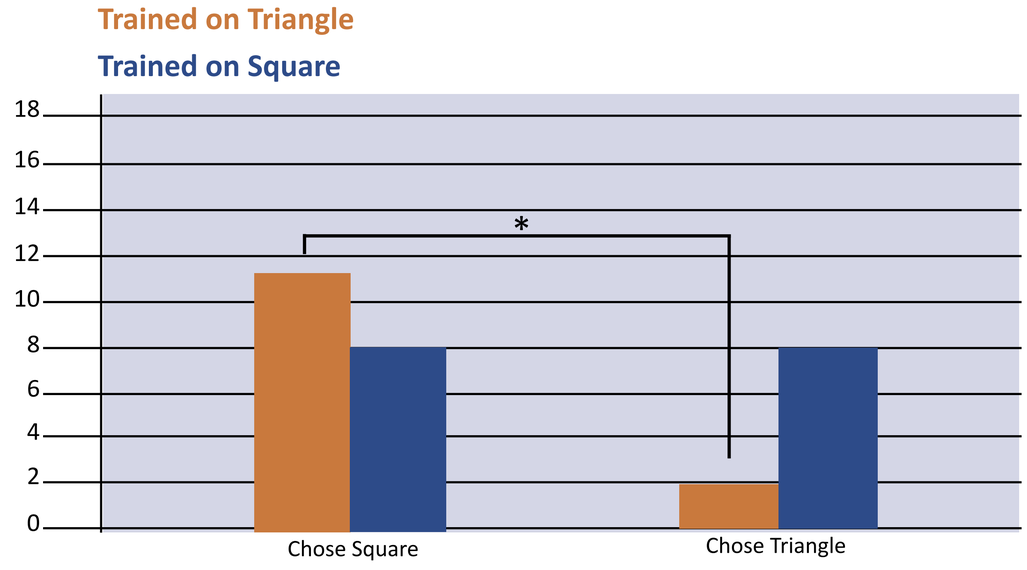
Results

29 spiders chose either shape in the test trial. All the analysis were run using a binomial test.



19 out of 29 spiders chose the shape non-rewarded at training though the differece is not significant (*p=0.136*). We performed further analysis to investigate this trend.

- No overall preference for either shape was found (19 spiders chose the square and 10 spiders choose the triangle)
- Spiders trained on the square showed no preference (8vs8)
- Spiders trained on the triangle showed a strong preference for the square (2vs11, *p=0.0225*)



- This preference holds when considering only the spiders trained on triangle who also passed the motivational test (0vs8, *p=0.0078*)

Discussion

Spiders of this family, and of this species, have been found capable of distinguishing between different colours (Jakob et al., J. Arachnology, 2007), and also different prey using only vision (Menda et al., Curr. Biol., 2014). This behaviour could be domain specific and not extended to non-salient geometrical shapes, though in our opinion this is unlikely so.

No proof of learning was found, although the tendency towards S- of the triangle-trained spiders needs to be addressed. There was no difference between subjects of the different groups and the shapes were matched for colour, distance from the starting point and total area. The preference could be explained by the intrinsic geometrical property of the square: in fact this shape can be perceived as two adjacent triangles.

Thanks for your attention!

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