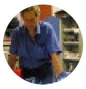
A sky polarization compass in lizards: which wavelengths of light are involved?

CONFERENCE PAPER · APRIL 2011

6 AUTHORS, INCLUDING:



Antonio Parretta
University of Ferrara

Ferruccio Petrucci
University of Ferrara

Augusto Foa
University of Ferrara Italia

A SKY POLARIZATION COMPASS IN LIZARDS: ONLY SOME WAVELENGTHS ARE INVOLVED

G. Beltrami[1]; P. Buttini[1], C. Bertolucci[1]; A. Parretta[2,3]; F. Petrucci[2,4]; and A. Foà[1]

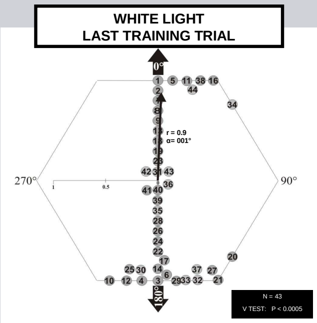
[1]Dipartimento di Biologia ed Evoluzione; [2]Dipartimento di Fisica, Università di Ferrara, Ferrara, Italy;
[3]ENEA, Centro Ricerche "E. Clementel", Bologna, Italy; [4]INFN, sezione di Ferrara, Italy

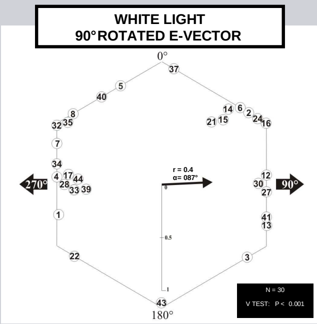
Purpose

We demonstrated that ruin lizard *Podarcis sicula* uses the e-vector direction of polarized light in compass orientation.
To perform this task, does *P. sicula use* a preferential region of the light spectrum?

Results

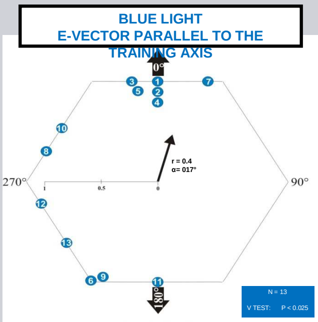
Ruin lizards were trained under white plane polarized light with a single *e*-vector and then were tested under 4 different chromatic polarized lights (**blue: 460nm**; **red: 611nm**; **green: 544nm**; **turquoise**).

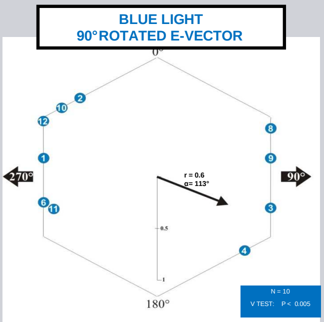


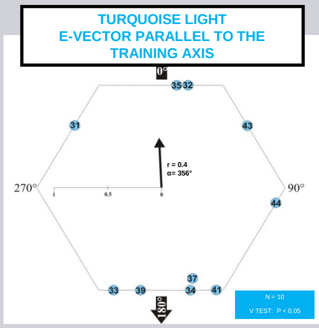


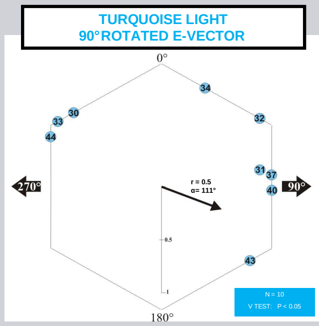
Legend: each symbol indicates the directional choice of a single lizard identified by its number. In each hexagon the inner arrow represents the mean vector of the group calculated after doubling the angles. In each hexagon the mean vector length (r) and the mean direction (α) of the group are reported. Solid line mean vector: the bearings distribution deviated from uniform; dotted line mean vector: the bearings distribution did not deviate from uniform. For each hexagon, the two outer solid arrows mark the expected axis of orientation.

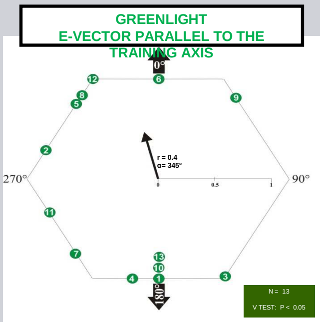
White Polarized Light: lizards (N= 43) meeting learning criteria (left panel), were subjected to 90° rotation of the e-vector direction (right panel). Lizards directional choices rotated correspondingly, producing a bimodal distribution which was perpendicular to the training axis.

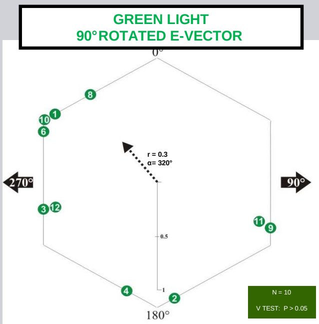


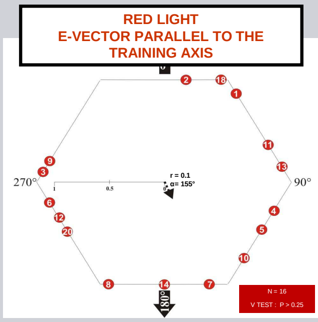






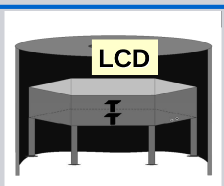




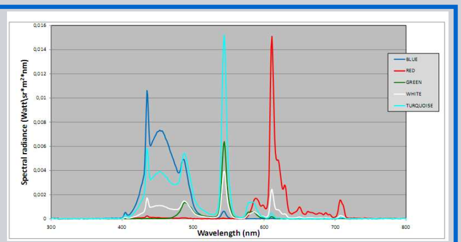


Under both **blue** light and **turquoise** light lizards were able to orientate in both *e*-vector's conditions, whereas under **red** light lizards resulted completely disorientated (so we tested lizards only under *e*-vector parallel to the training axis). Under **green** light lizards were able to orientated themselves only when the direction of the *e*-vector was the same as in training, whereas after 90° rotation of the *e*-vector lizards were disorientated.

Conclusions: present data showed that both the **blue** and the **turquoise** wavelengths are crucial for perceiving *e*-vector, whereas the **red** wavelength did not mediate the perception of the *e*-vector. The **green** wavelength's results were borderline. Furthermore, the present experiment confirmed that in the ruin lizard the **UV** is not necessary to perceive polarized light.



Methods: we trained and tested lizards inside an hexagonal Morris water maze, filled with obscured water and positioned under an LCD screen producing by itself plane polarized light. Lizards were subjected to axial training by positioning two identical goals in contact with the centre of two opposite side walls along the axis 0–180° (the training axis) of the maze. After reaching learning criteria, lizards could be tested under different chromatic polarized lights, both with *e*-vector parallel to the training axis and after 90° *e*-vector rotation.



ACKNOWLEDGEMENTS
This work was supported by University of Ferrara research grants. We are grateful to Federico Evangelisti and Stefano Squerzanti (Istituto Nazionale di Fisica Nucleare–Sezione di Ferrara), Luca Landi (Dipartimento di Fisica, Università di Ferrara) for technical assistance. We are also grateful to Edoardo Chiodelli and Vincenzo Ricci (Photo Analytical S.r.l) for the spectral measurements.