

A model of visual and wind cue integration in the central complex

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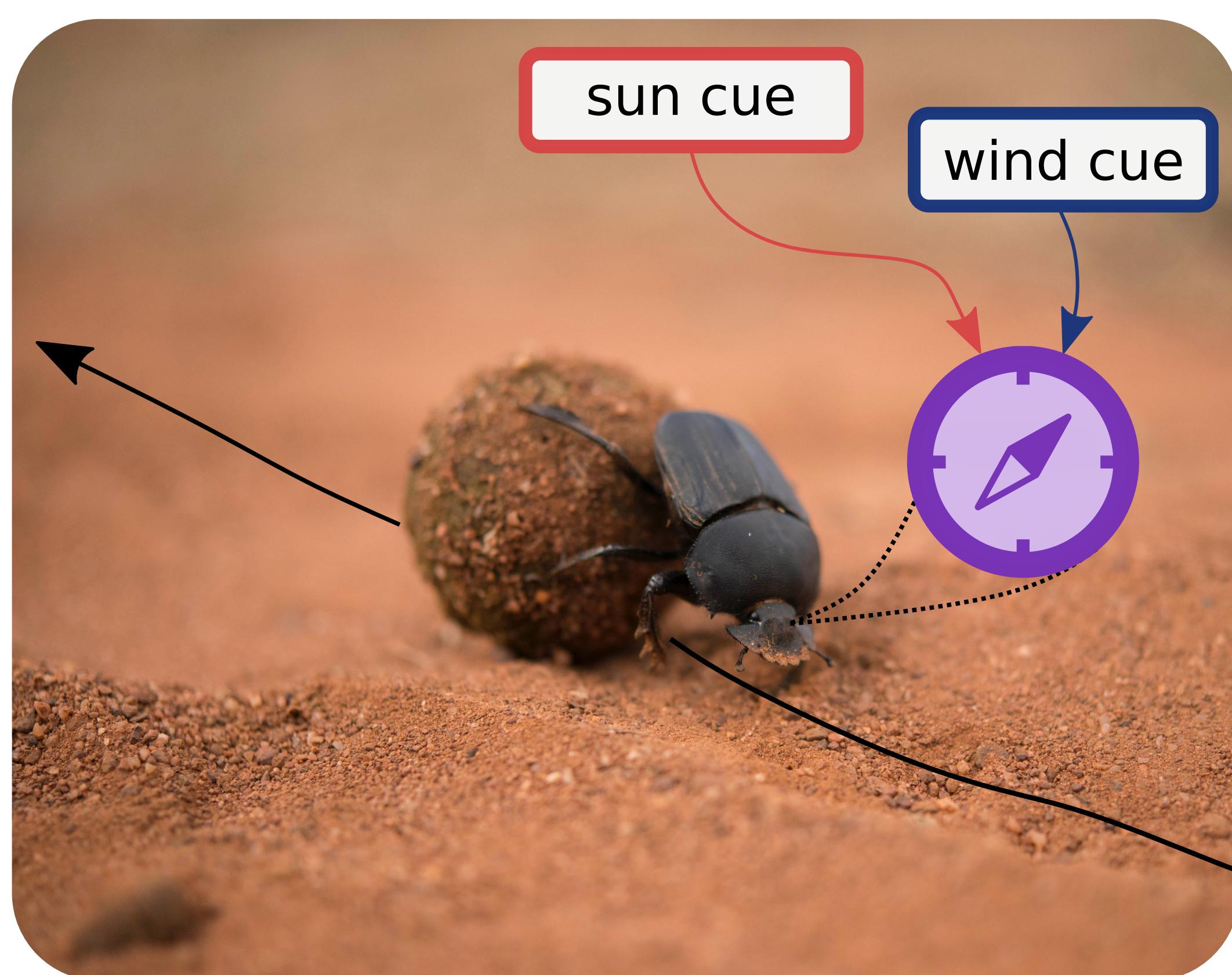
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Background

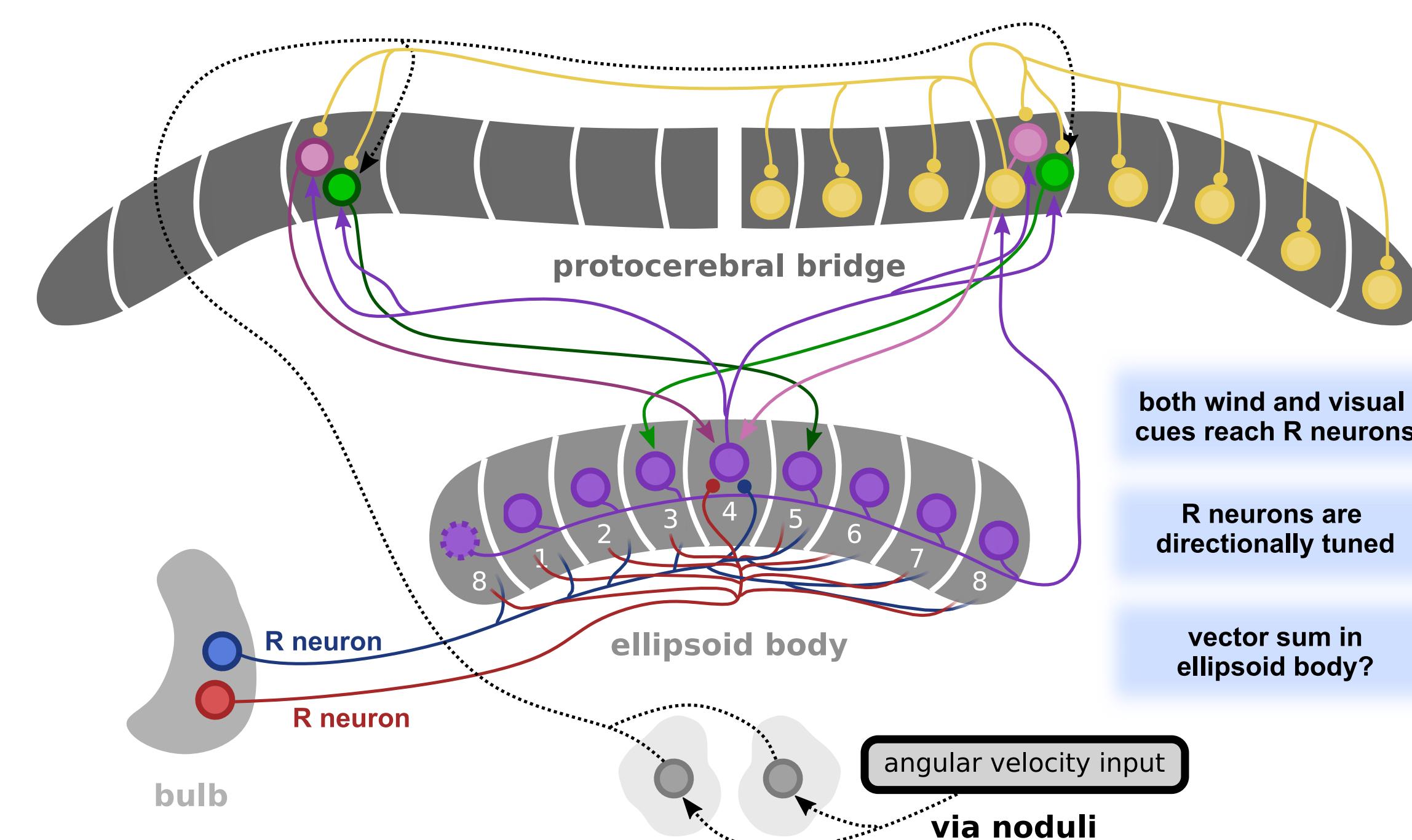
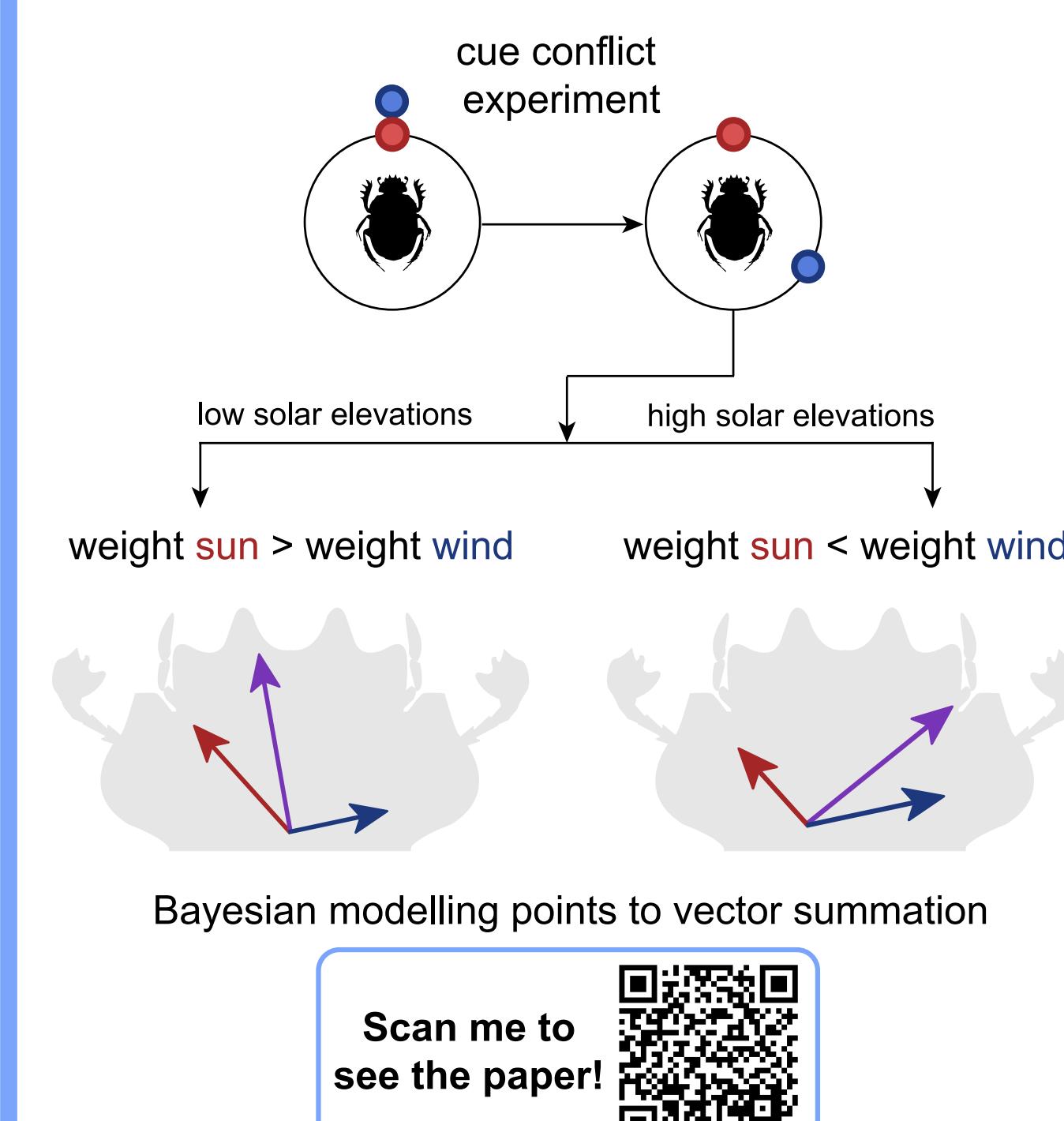
Ball-rolling dung beetles integrate multiple orientation cues for straight-line orientation

Their cue integration behaviour is best explained by vector summation

Does the central complex provide a substrate for compass cue integration as vector summation?

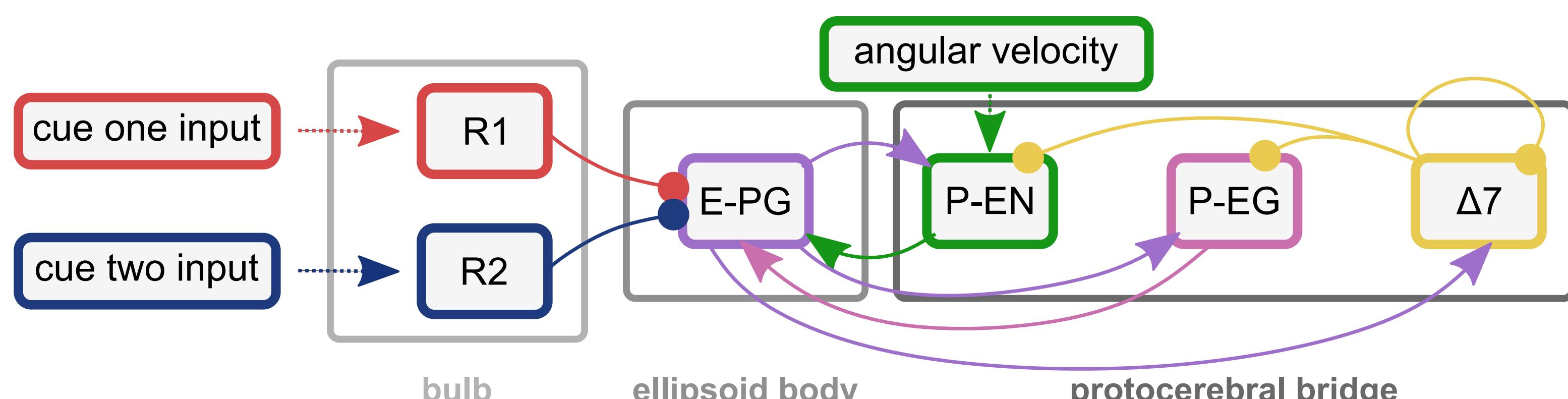


Poster 67

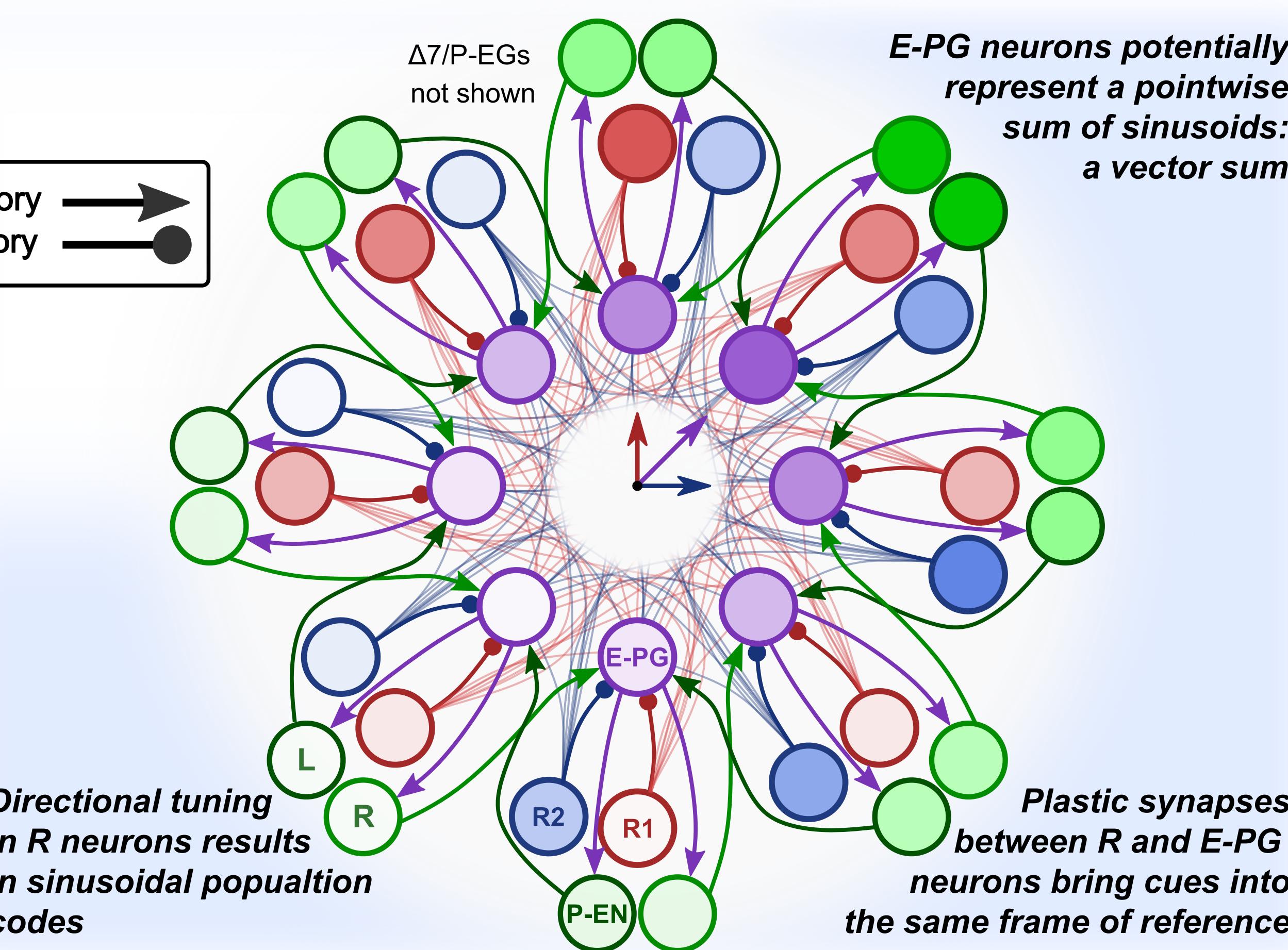


Model

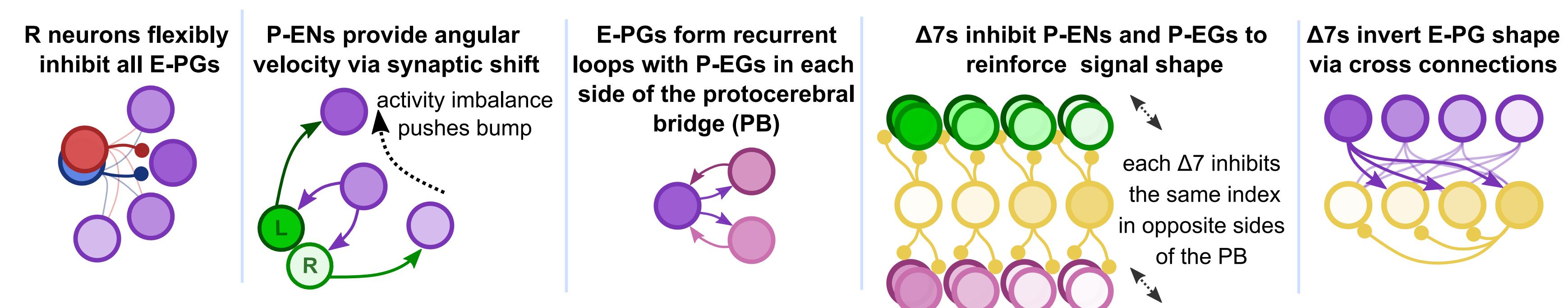
Circuit flow diagram



Multimodal compass circuit

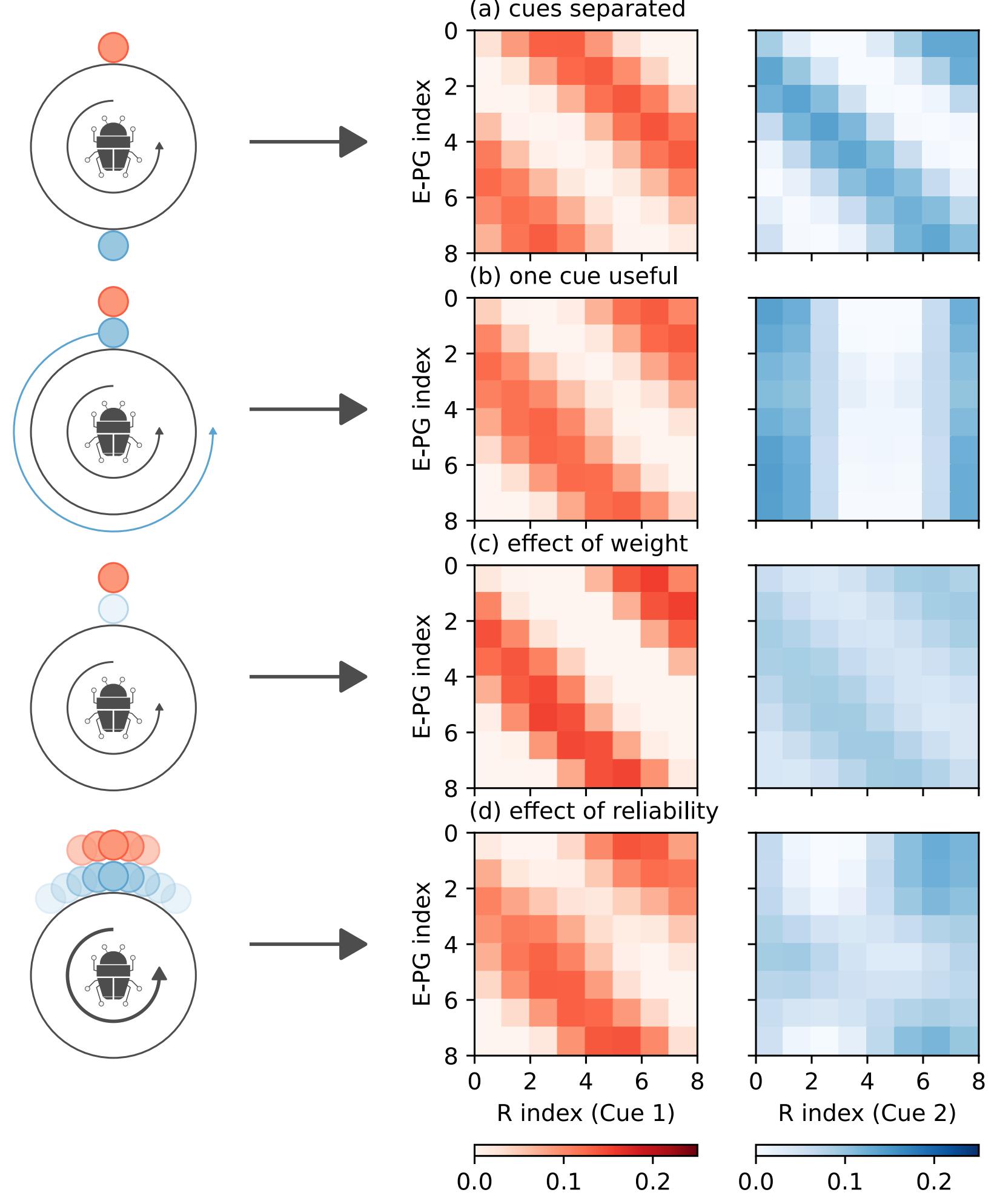


Neuron interactions

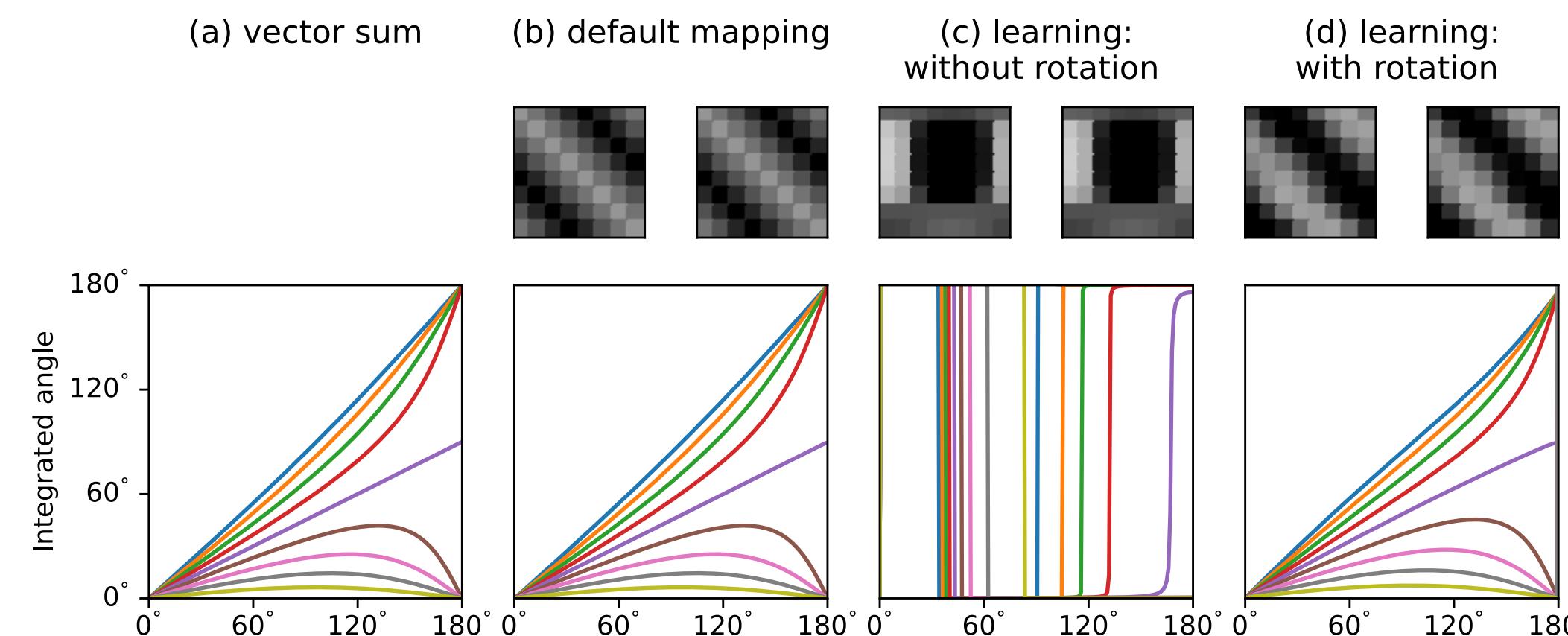


Results

Hebbian learning stores cue state information



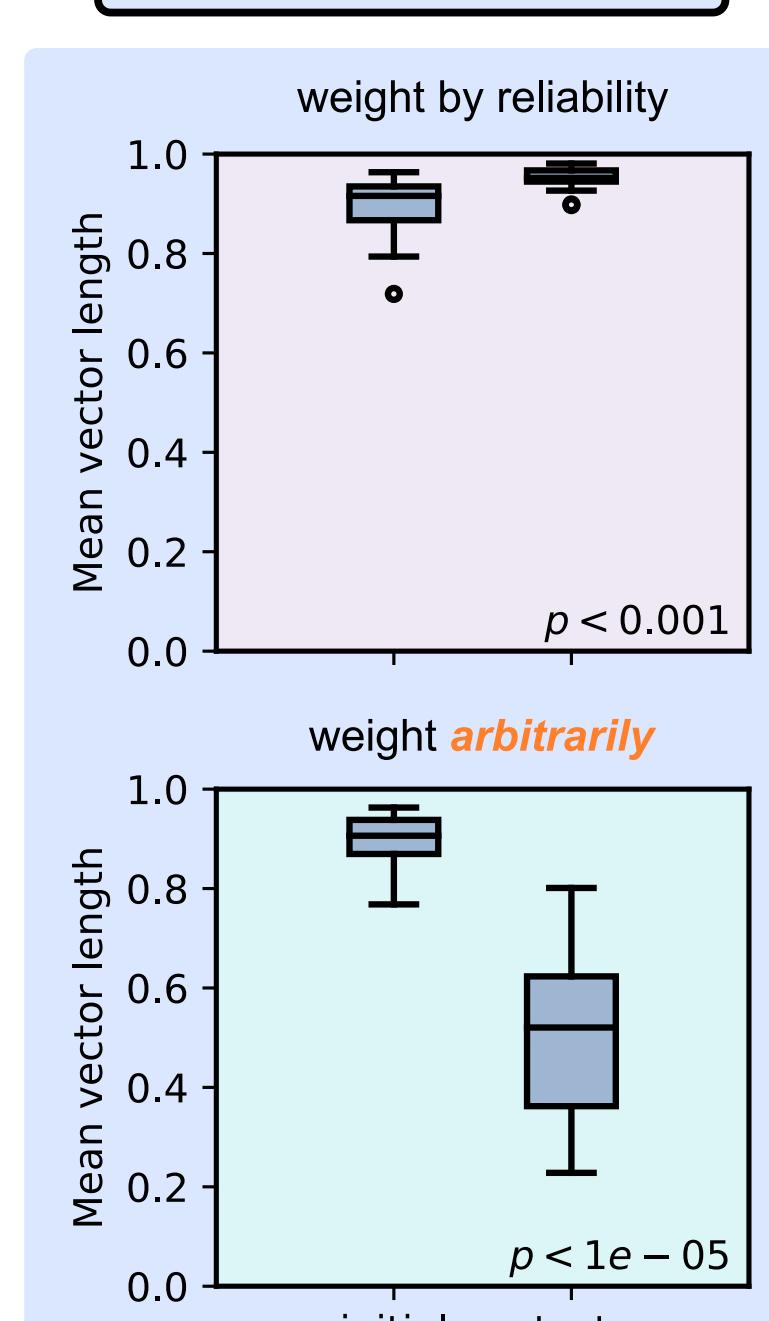
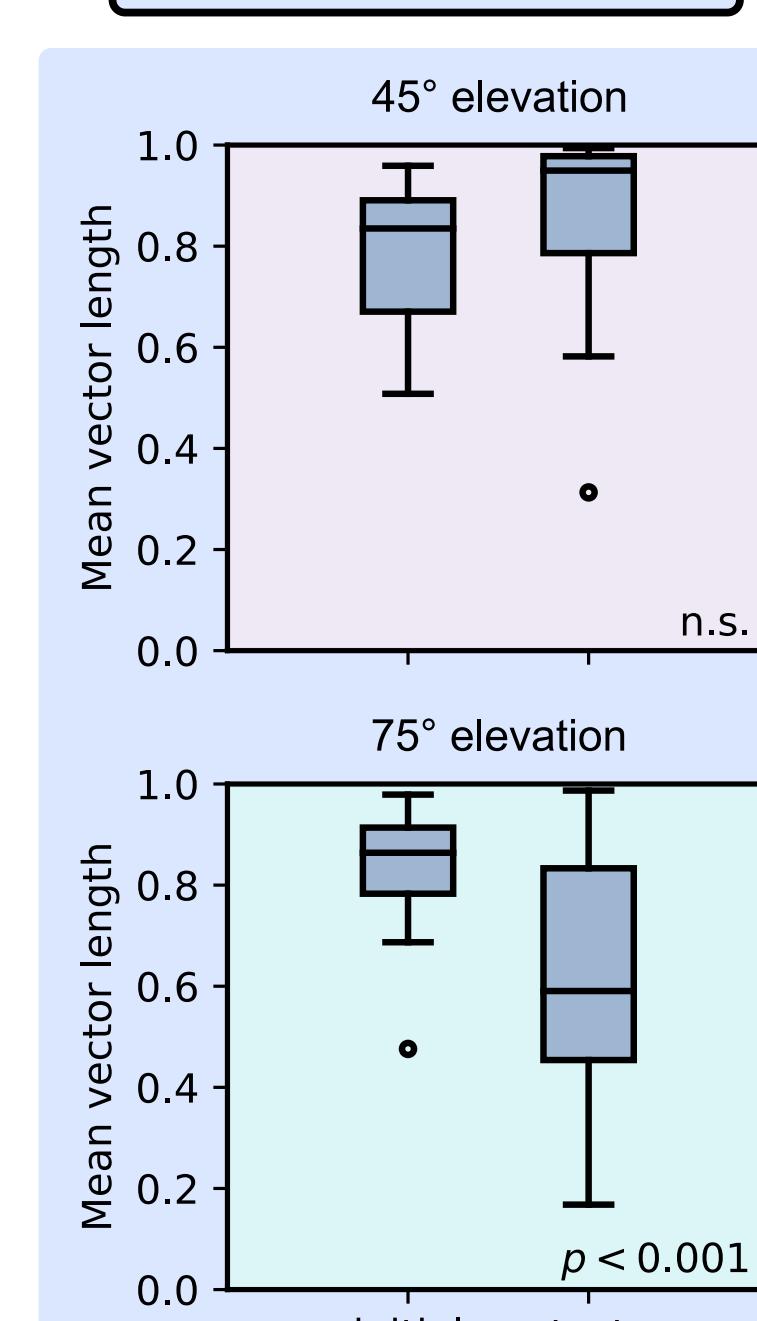
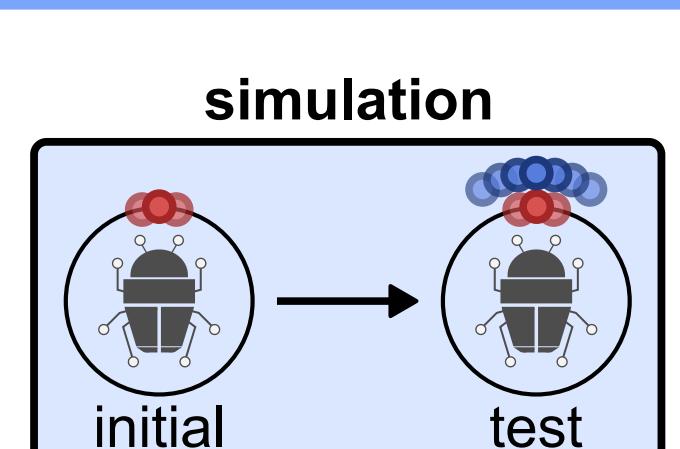
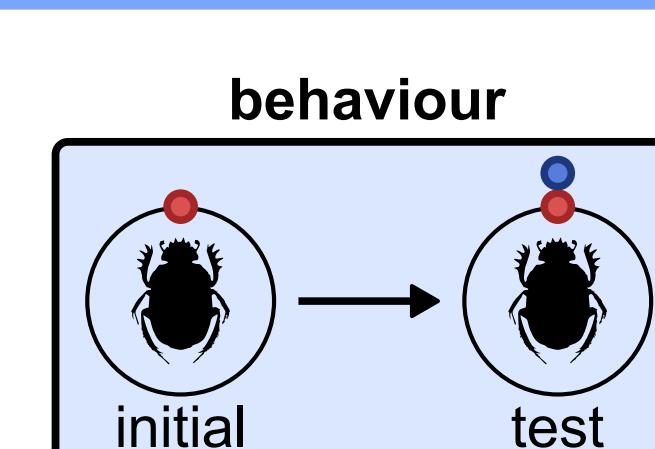
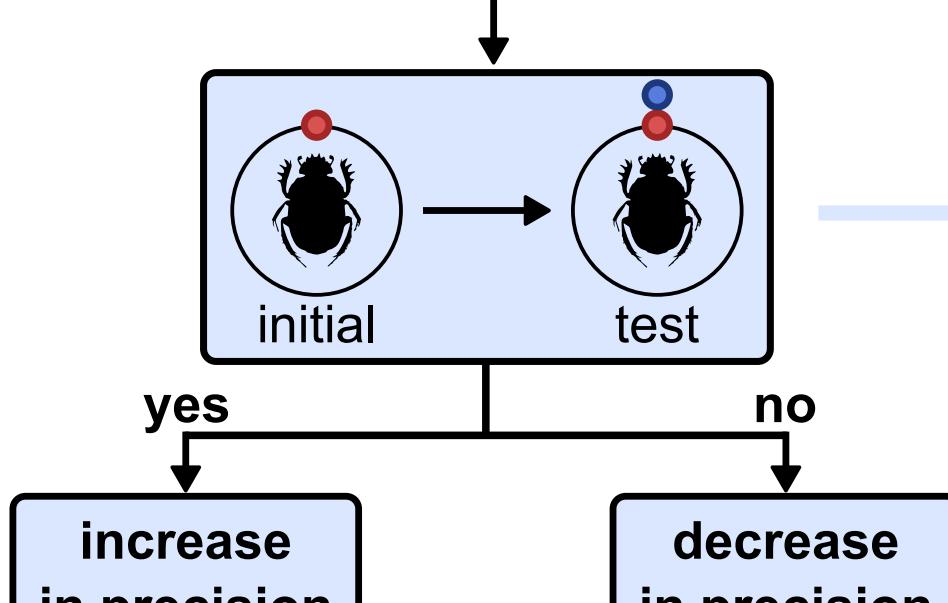
The circuit can encode a vector sum



'Reliability' = inverse of variance
Theory says cue weight should be coupled to reliability, but...
no clear link between weight and reliability
Anatomy does not require that orientation cues are weighted according to their reliability

Behavioural test

do dung beetles weight cues according to their relative reliabilities?



Dung beetles do not weight cues according to their reliability

Apparent arbitrary weighting could be an attempt to use a proxy for reliability, e.g. cue contrast



Relevant review articles

Central complex anatomy
Yvette Fisher. Flexible navigational computations in the Drosophila central complex. *Curr. Op. Neurobiol.* (2022).

Dung beetle behaviour
Marie Dacke et al. How Dung Beetles Steer Straight. *Annu. Rev. Entomol.* (2021)