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A new experimental design to uncorrelate visual cues in honeybees' altitude control

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Experimental set up's aim: is baseline's splay angle rate of change involved in altitude control in *Apis mellifera* ?

two optical invariants:

- optical scrolling speed $\dot{S} = 0$
- base lines' splay angle rate of change $\dot{\omega} = 0$

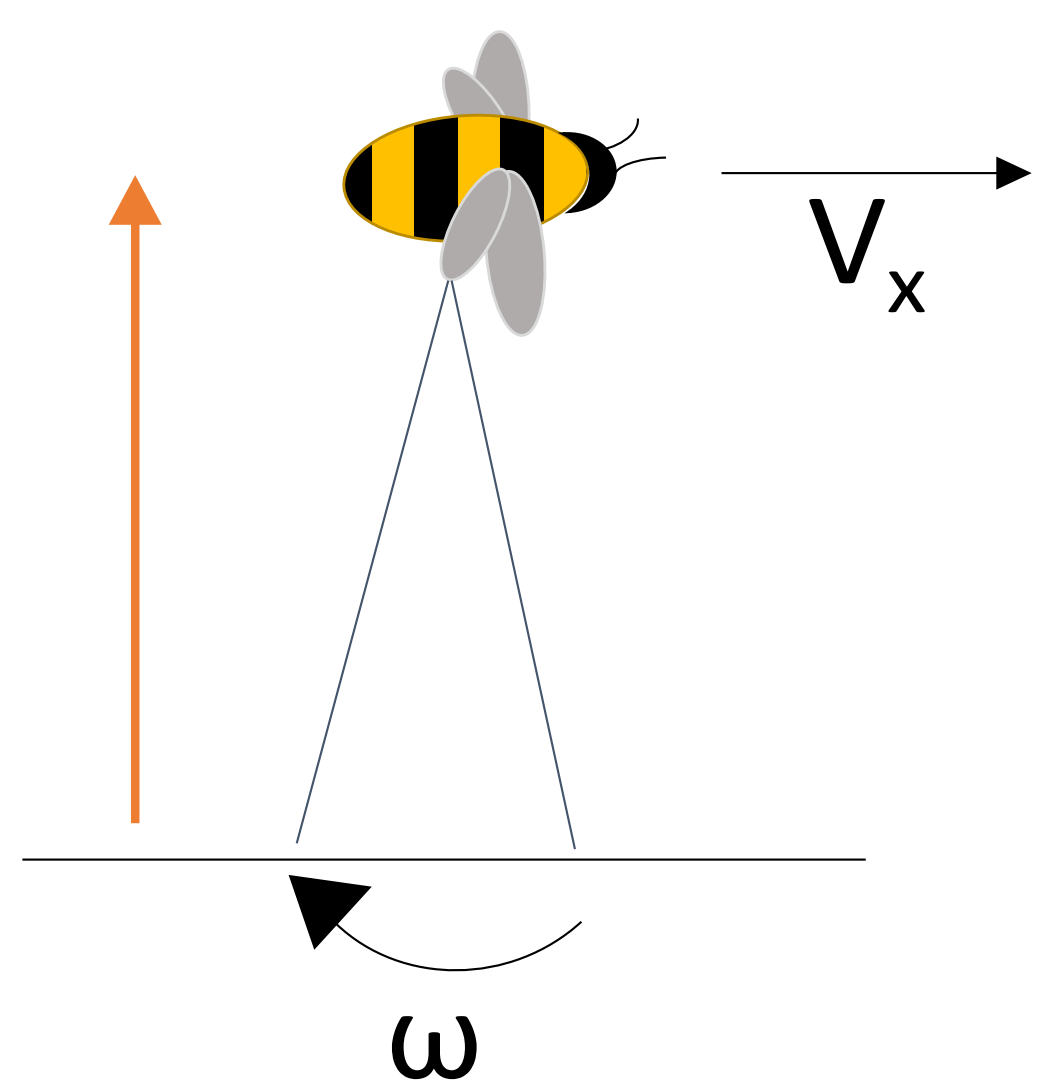
--> optical invariants can be uncorrelated

--> optical invariants can be individually suppressed

--> optical invariants can be distorted

Optical scrolling speed (OSS) experienced by a flying agent

altitude (z)



$$\omega = \frac{V_x}{z}$$

$$\dot{\omega} = 0$$

[1, 2, 3, 4, 7]

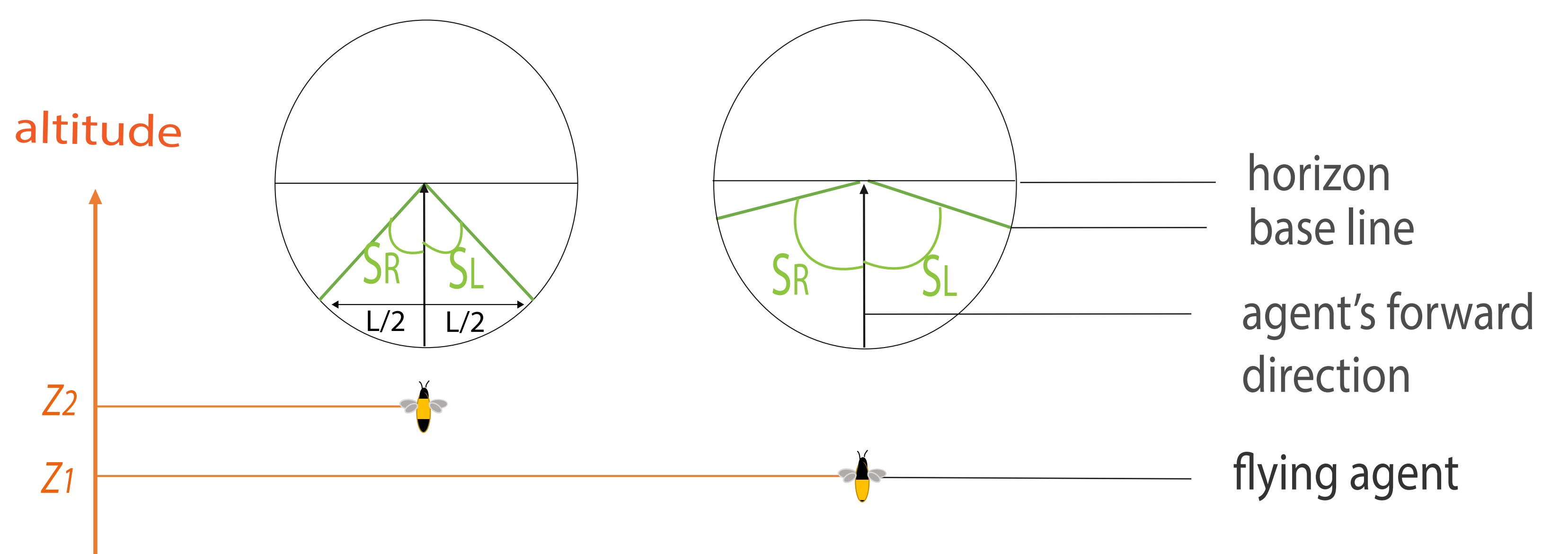
Splay angle's rate of change experienced by a flying agent

$S = 1/2$ angle formed by base lines
 $S_R = \text{right splay}$; $S_L = \text{left splay}$

$S_R = S_L = S$ for a centered bee
 $L = \text{path width}$

$$S = \arctan\left(\frac{L/2}{z}\right)$$

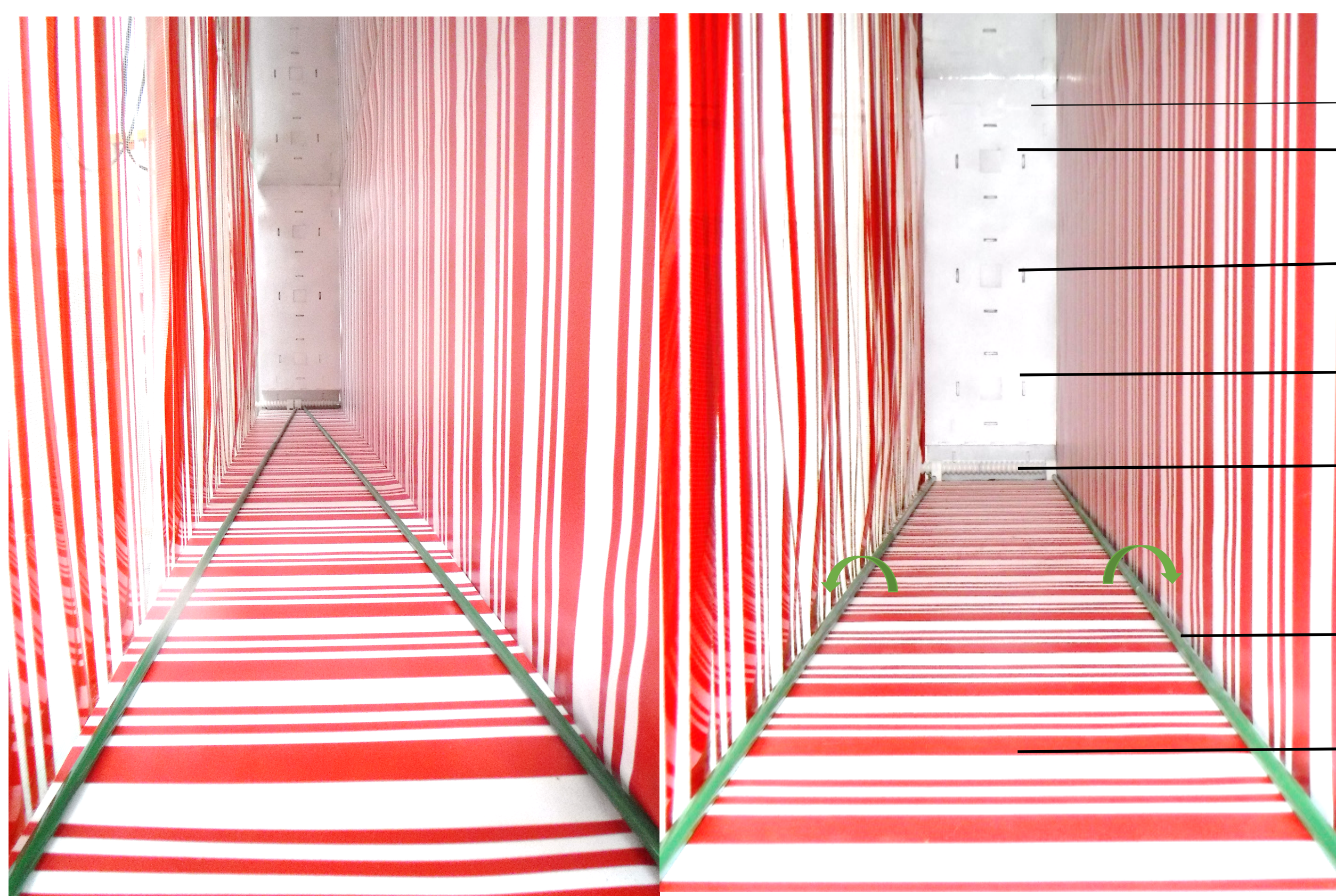
$$\dot{S} = 0$$



based on [6] in humans

[5, 6]

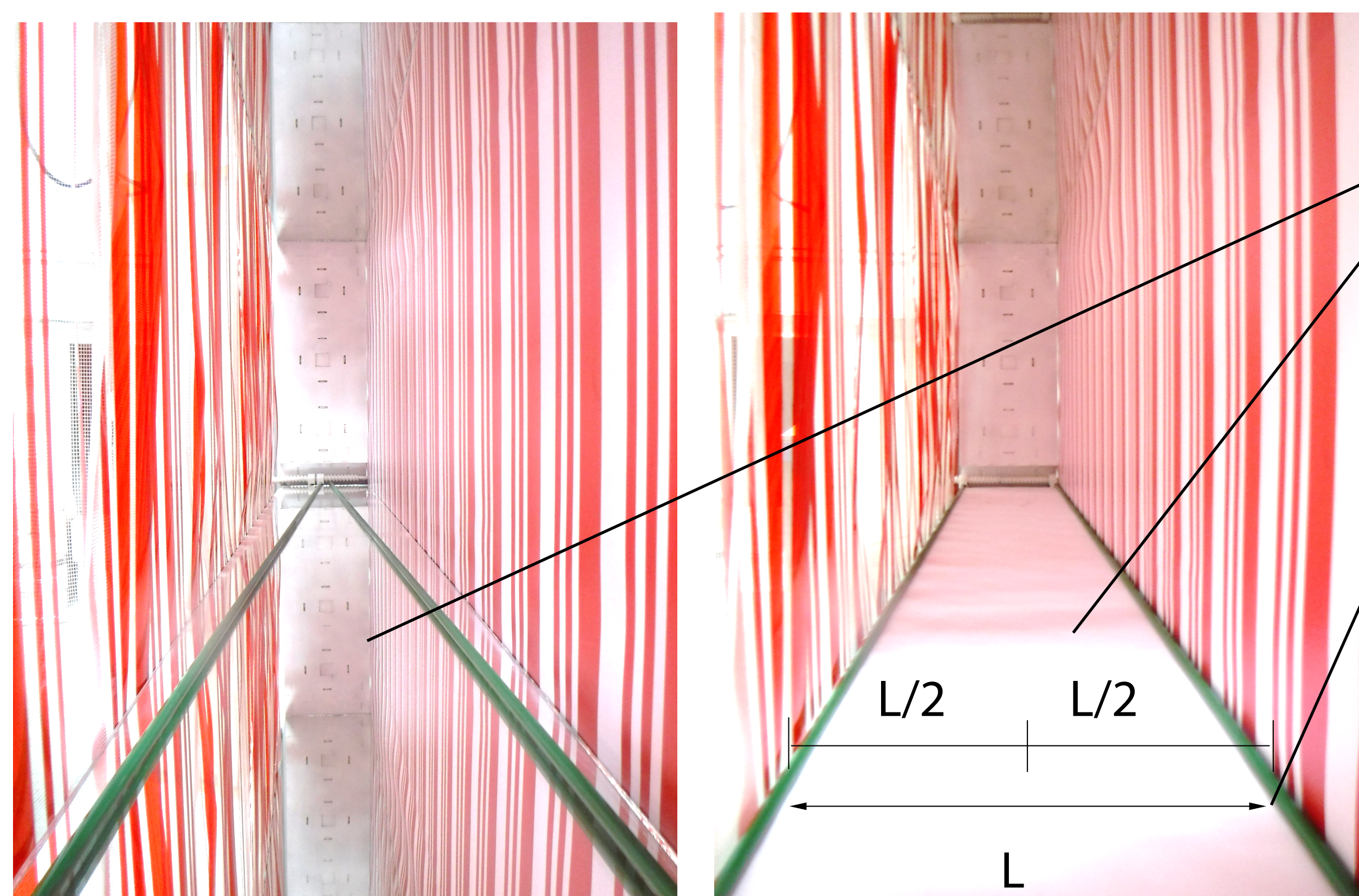
Experimental set up



- minimized visual clues
- 3 possible entrances/exits provided with food reward
- two-way metric screw operated by a brushless motor
- mobile stick
- OSS available

OSS available
Narrowed splay angle

OSS available
Real splay angle



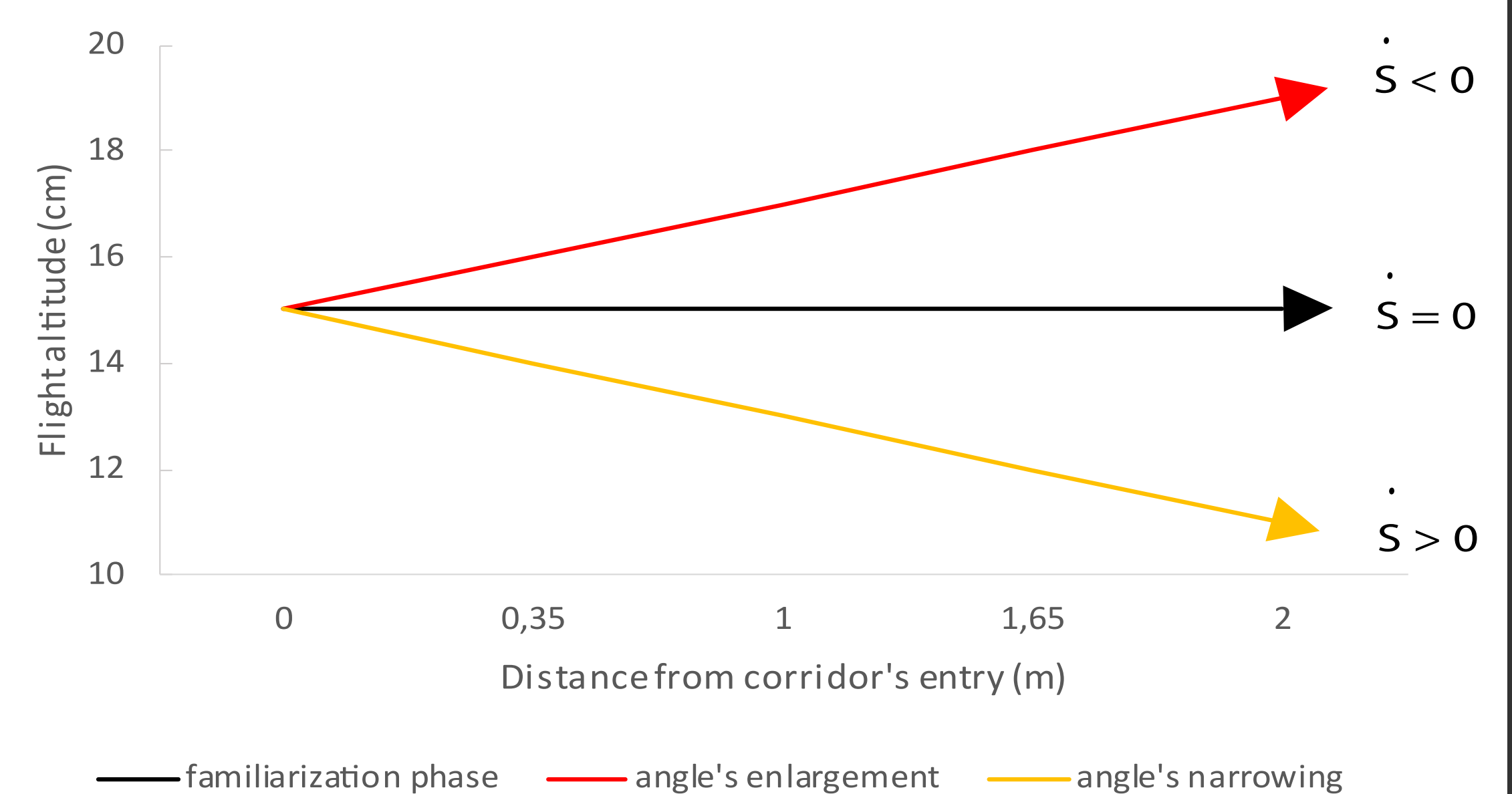
no OSS available

corridor width

No OSS available
Narrowed splay angle

No OSS available
Real splay angle

Predictive bee's altitude in response to an apparent splay angle rate of change



$$\dot{S} = -\frac{\frac{L}{2}}{z^2 + \left(\frac{L}{2}\right)^2} \cdot \dot{z}$$

Perceived	Meaning	Response
\dot{S}	\dot{z}	\dot{z}
\dot{S}	\dot{z}	\dot{z}

Question : ? < S < ? (° · S⁻¹)

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