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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 $\dot{\omega} = 0$

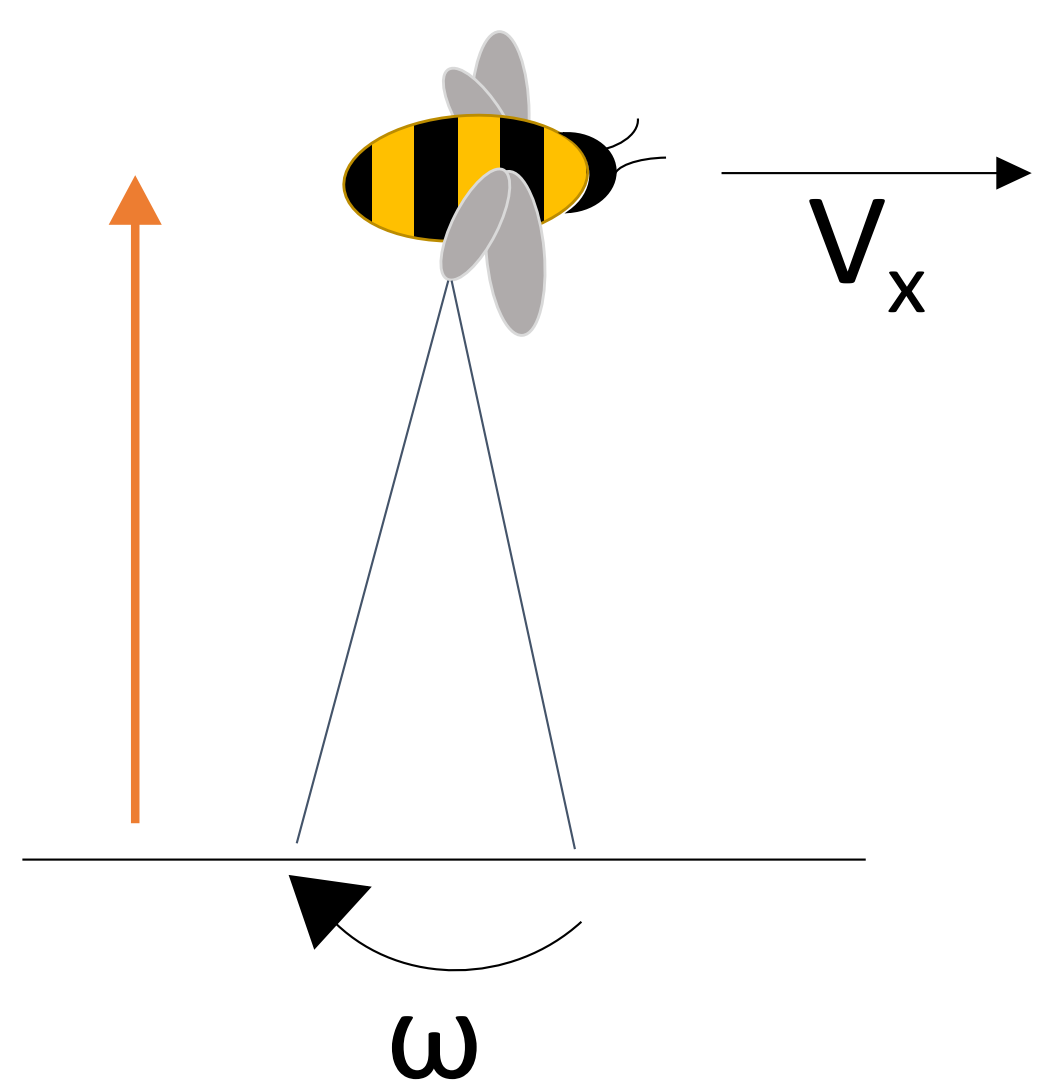
--> optical invariants can be uncorrelated

--> 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]

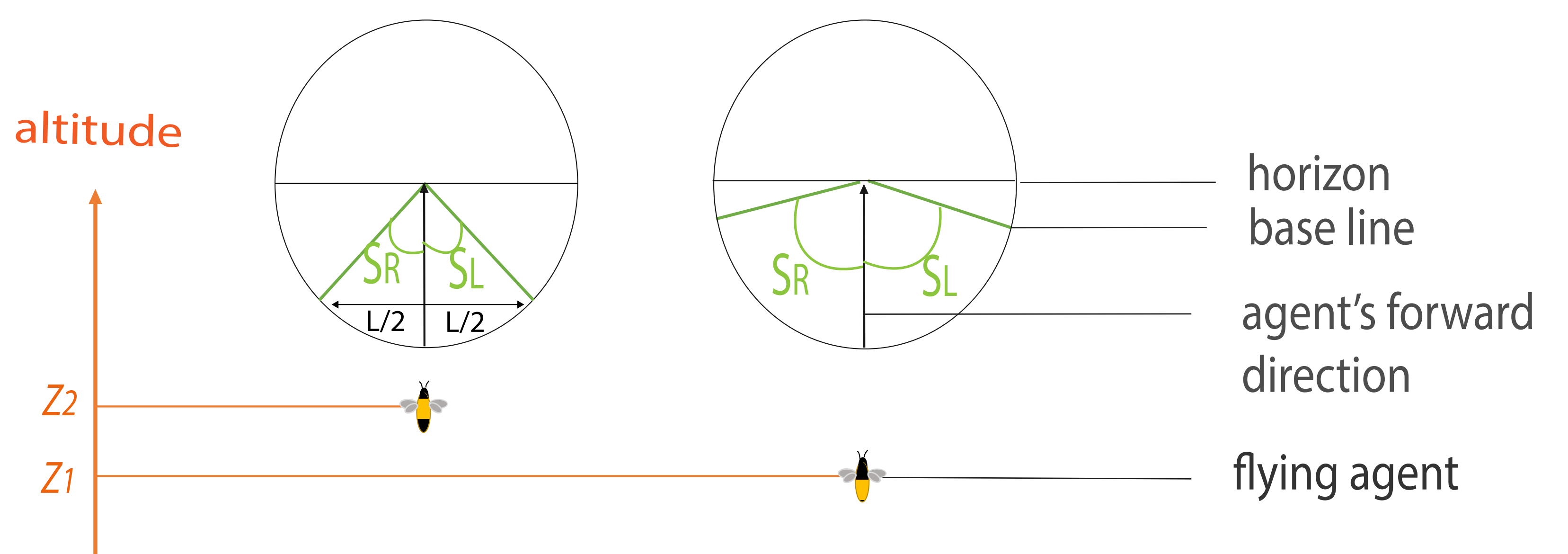
Splay angle's rate of change experienced by a flying agent

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

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

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

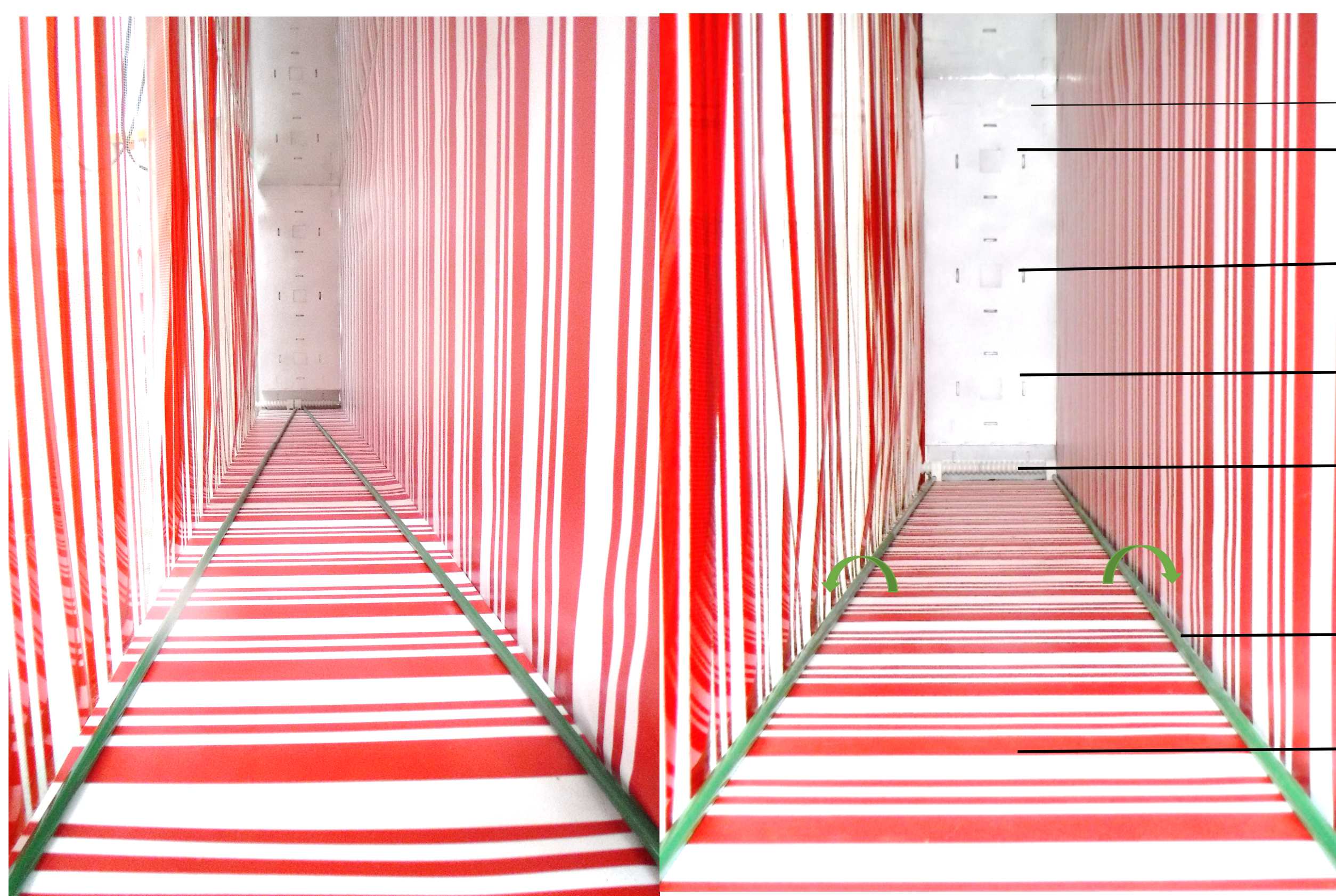
$$\dot{S} = 0$$



based on [6] in humans

[5, 6]

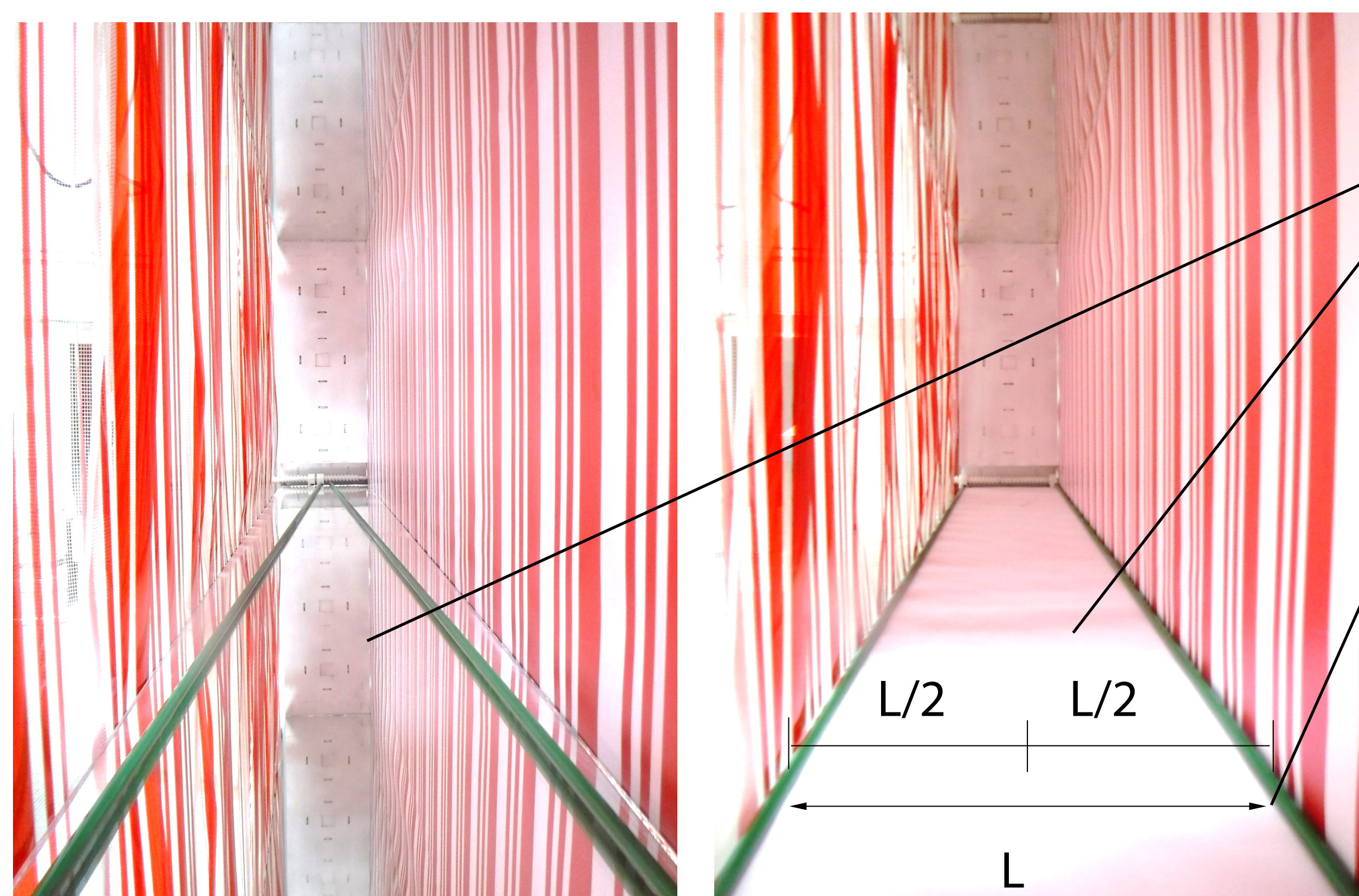
Experimental set up



- 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

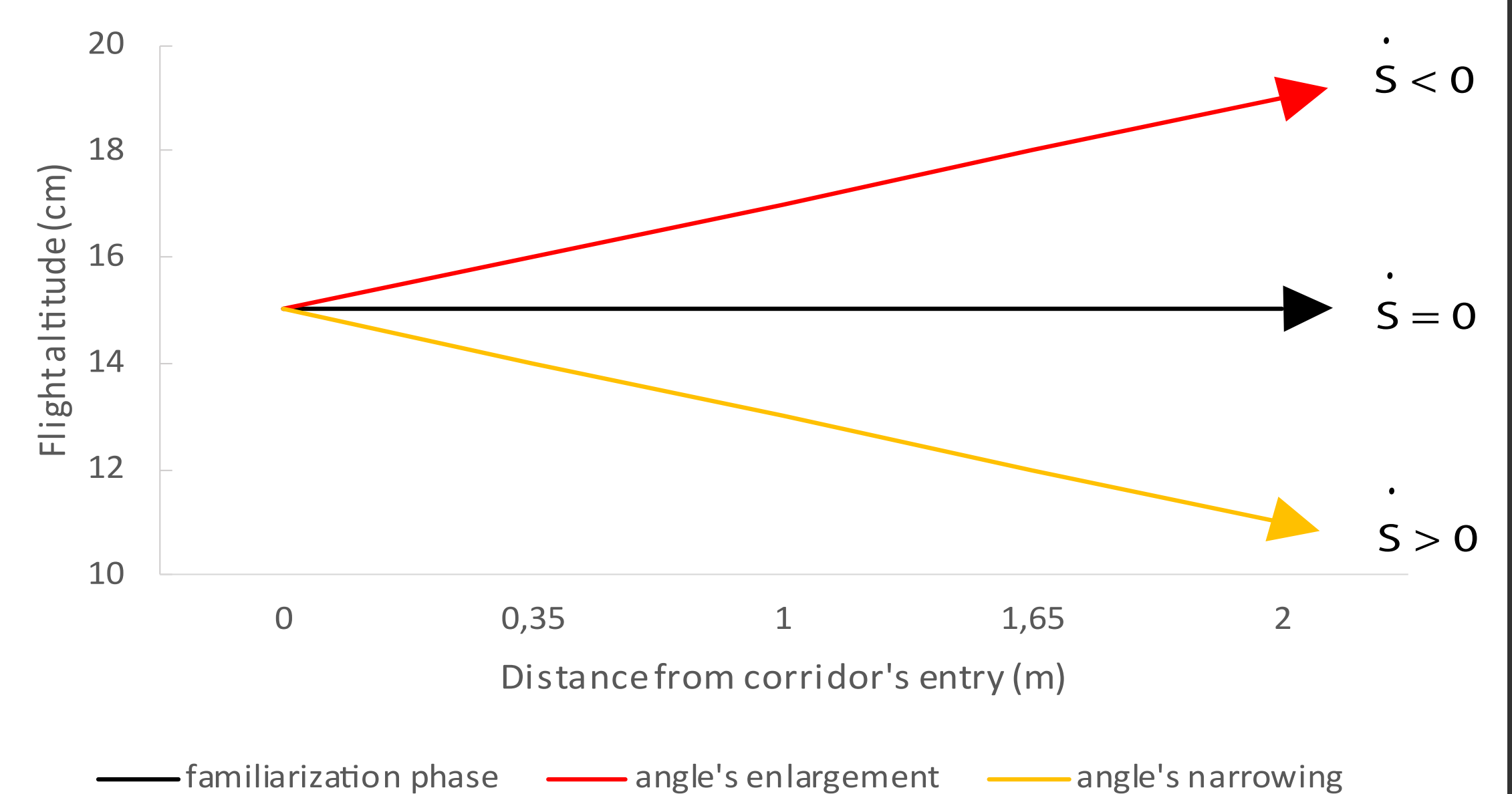
corridor width

$L/2$ $L/2$
 L

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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