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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 $\dot{\omega} = 0$

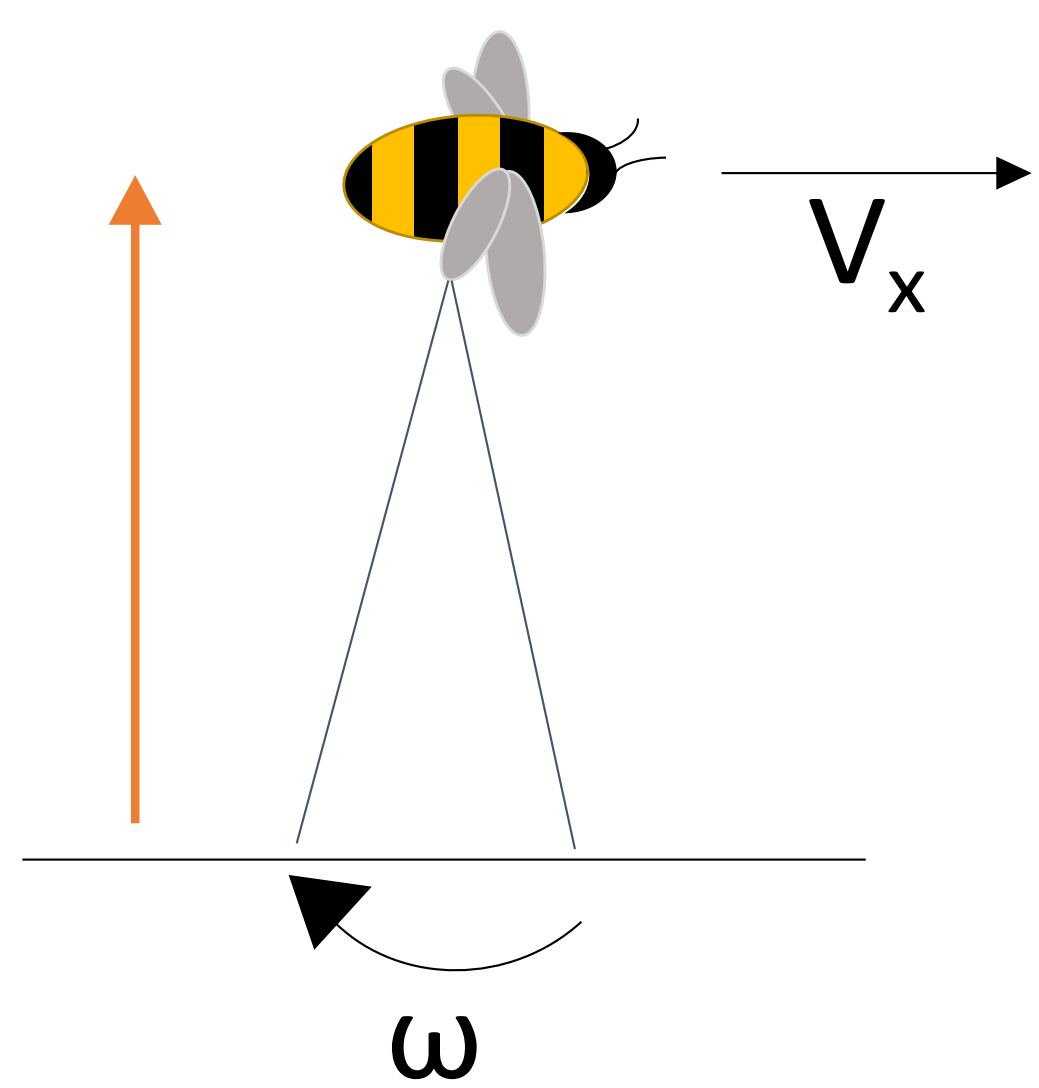
--> optical invariants can be uncorrelated

--> 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
 $S_R = \text{right splay}$; $S_L = \text{left splay}$

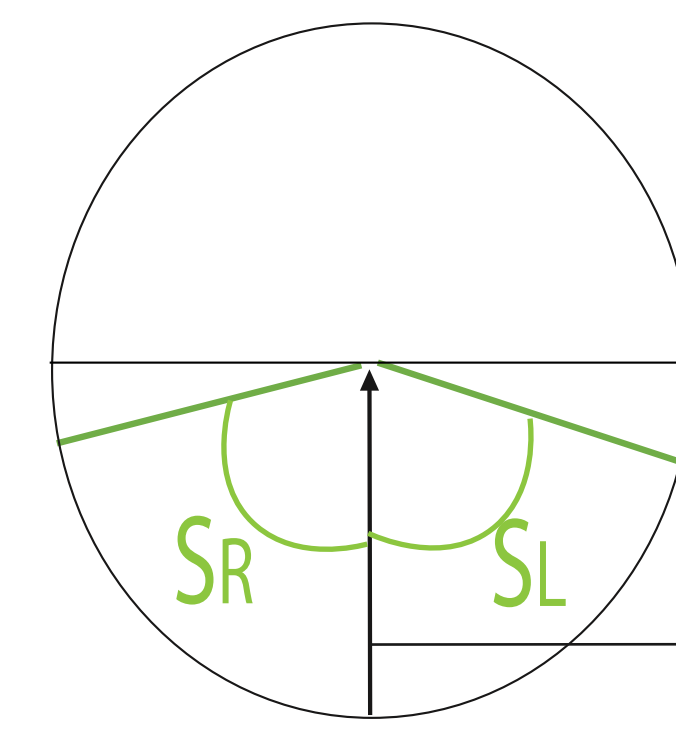
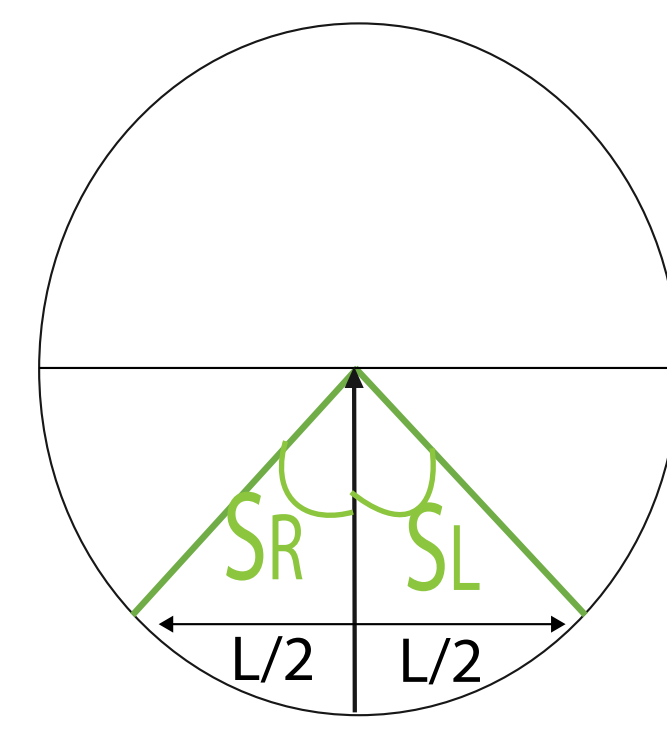
$S_R = S_L = S$ for a centered bee
 $L = \text{path width}$

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

$$\dot{S} = 0$$

altitude

z_2
 z_1

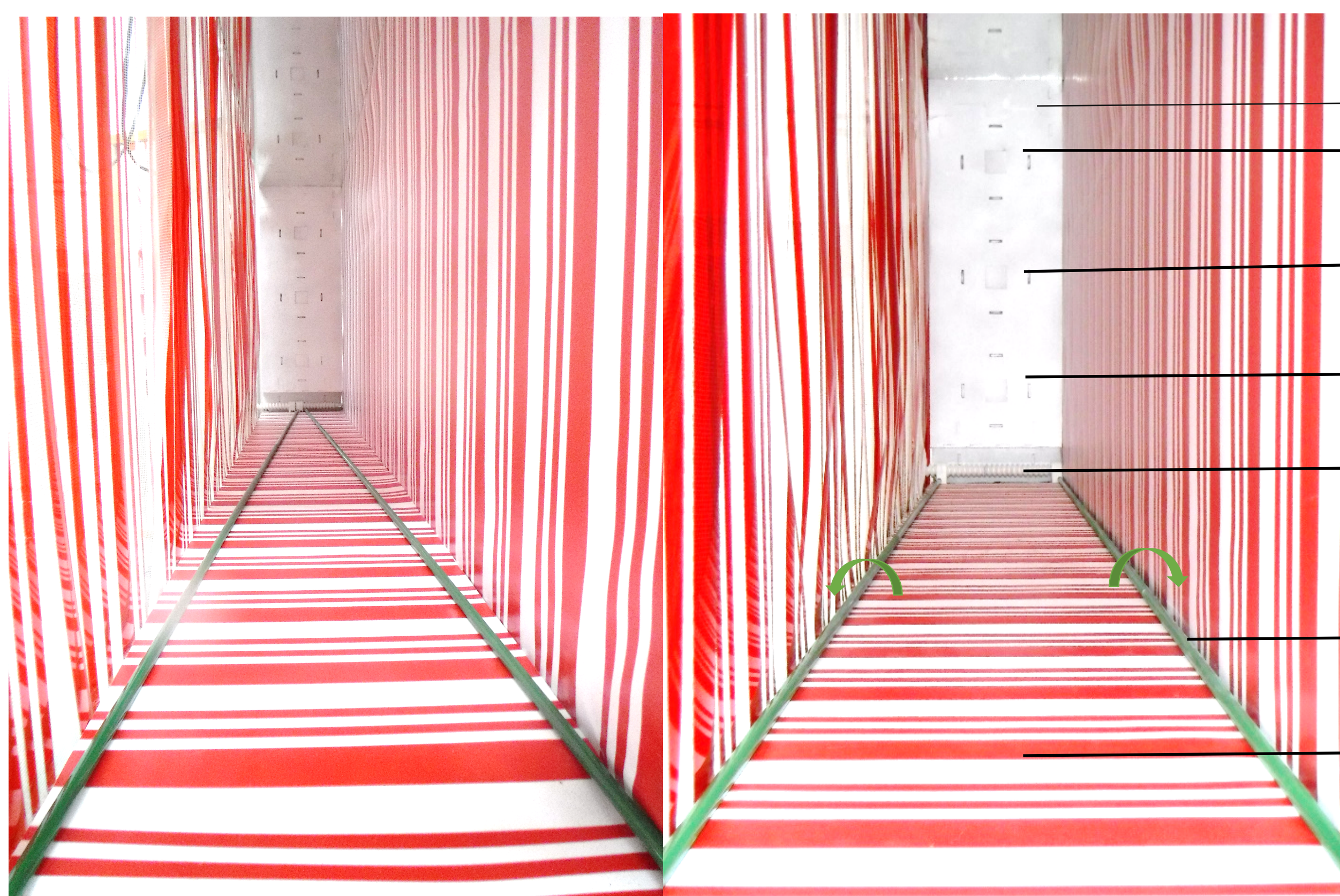


horizon
base line
agent's forward
direction
flying agent

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

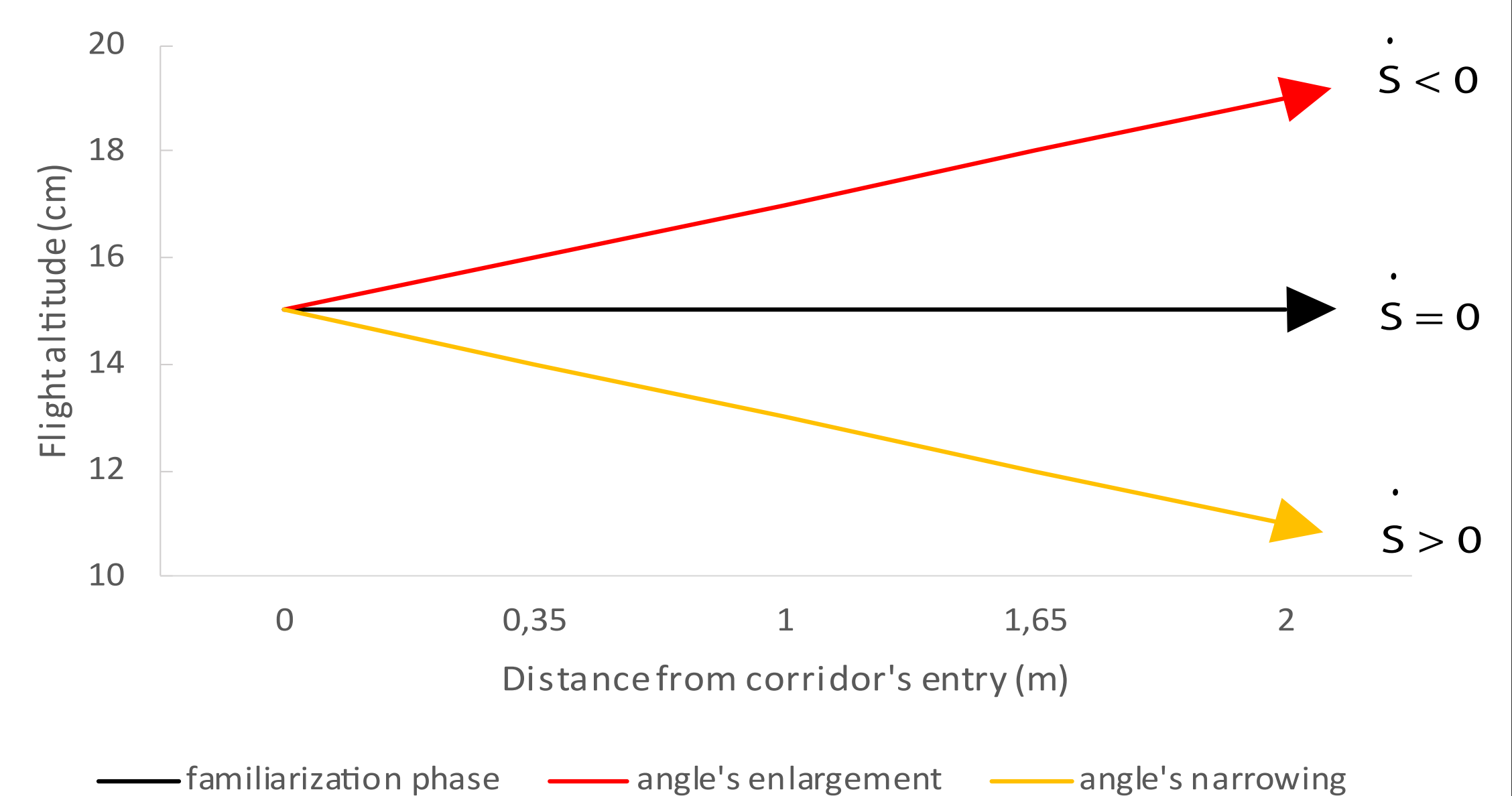
mobile stick

OSS available

OSS available
Narrowed splay angle

OSS available
Real splay angle

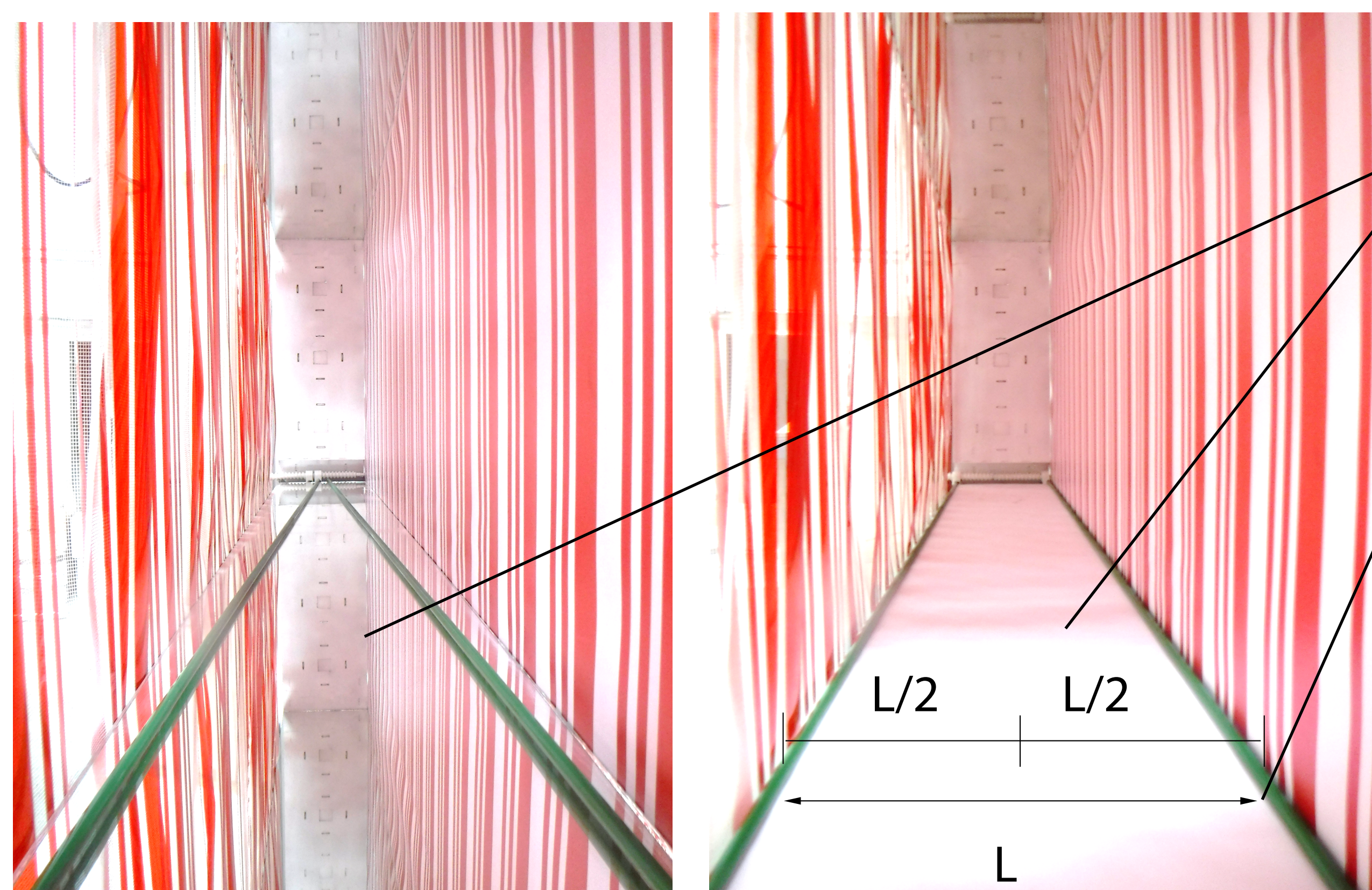
Predictive bee's altitude in response to
an apparent splay angle rate of change



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

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

Question : ? < S < ? (° . S⁻¹)



no OSS available

corridor width

$L/2$
 $L/2$
 L

No OSS available
Narrowed splay angle

No OSS available
Real splay angle

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