

# Do developmental changes in fitness trade-offs predict how embryos use mechanosensory cues for escape-hatching decisions?

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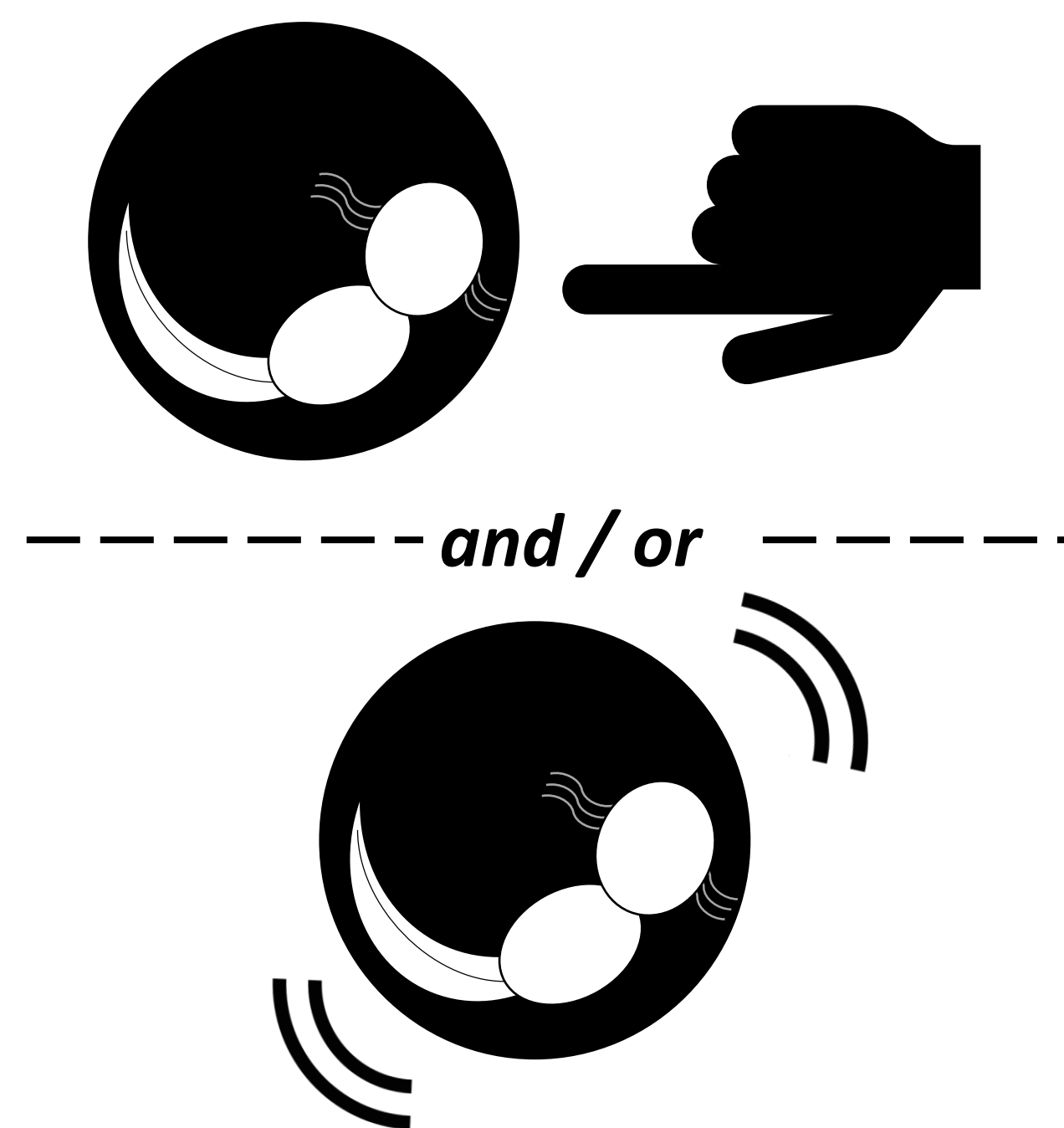
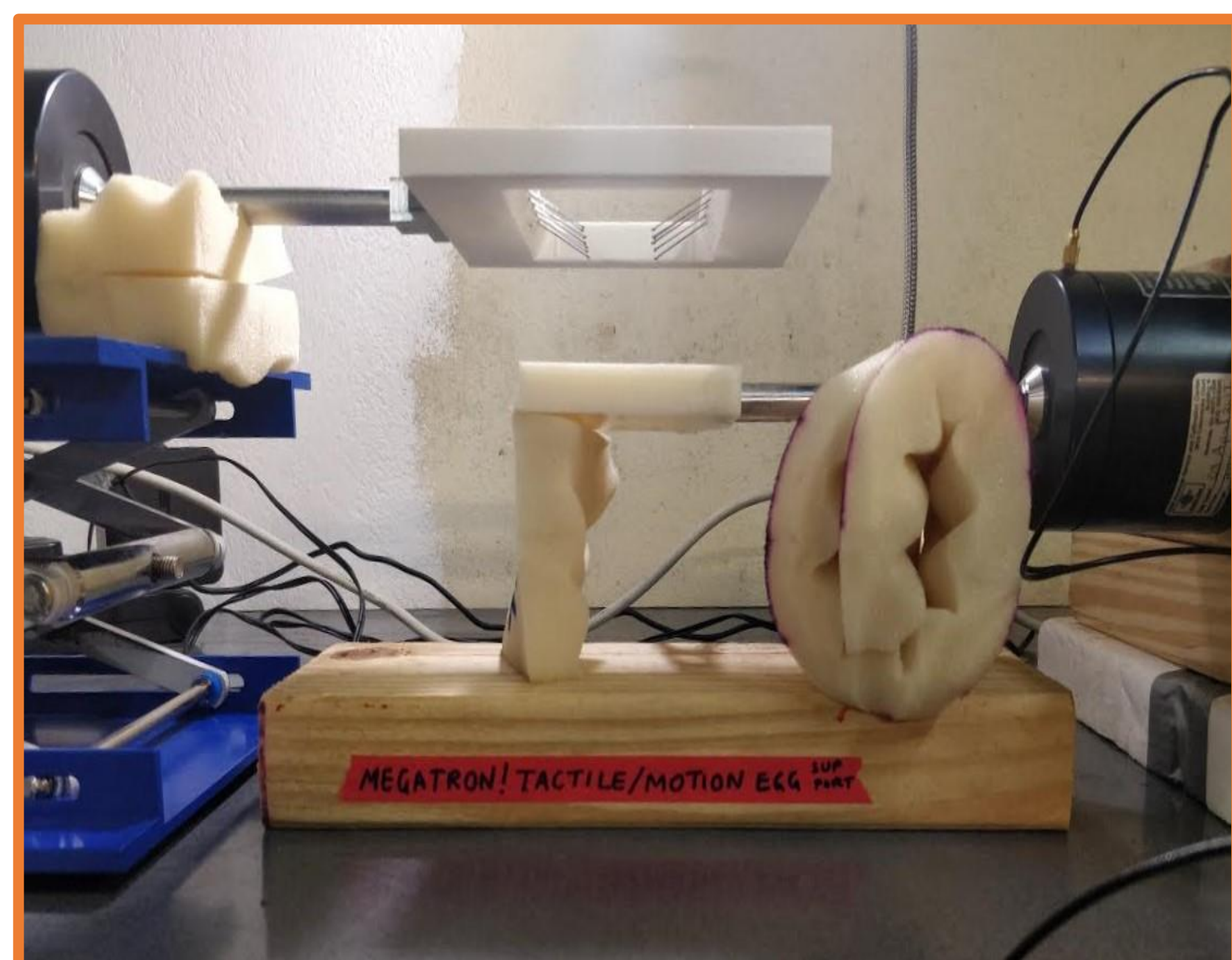
## Background

Red-eyed treefrog (*Agalychnis callidryas*) embryos use physical disturbance in egg-predator attacks to cue escape-hatching.

Missing predator cues is always costly, but false alarm costs decrease with development.

## Methods

E1-2. We used a playback system to present **tactile contact** (rubbing), **motion** (vibration), or **both** cues, to embryos.



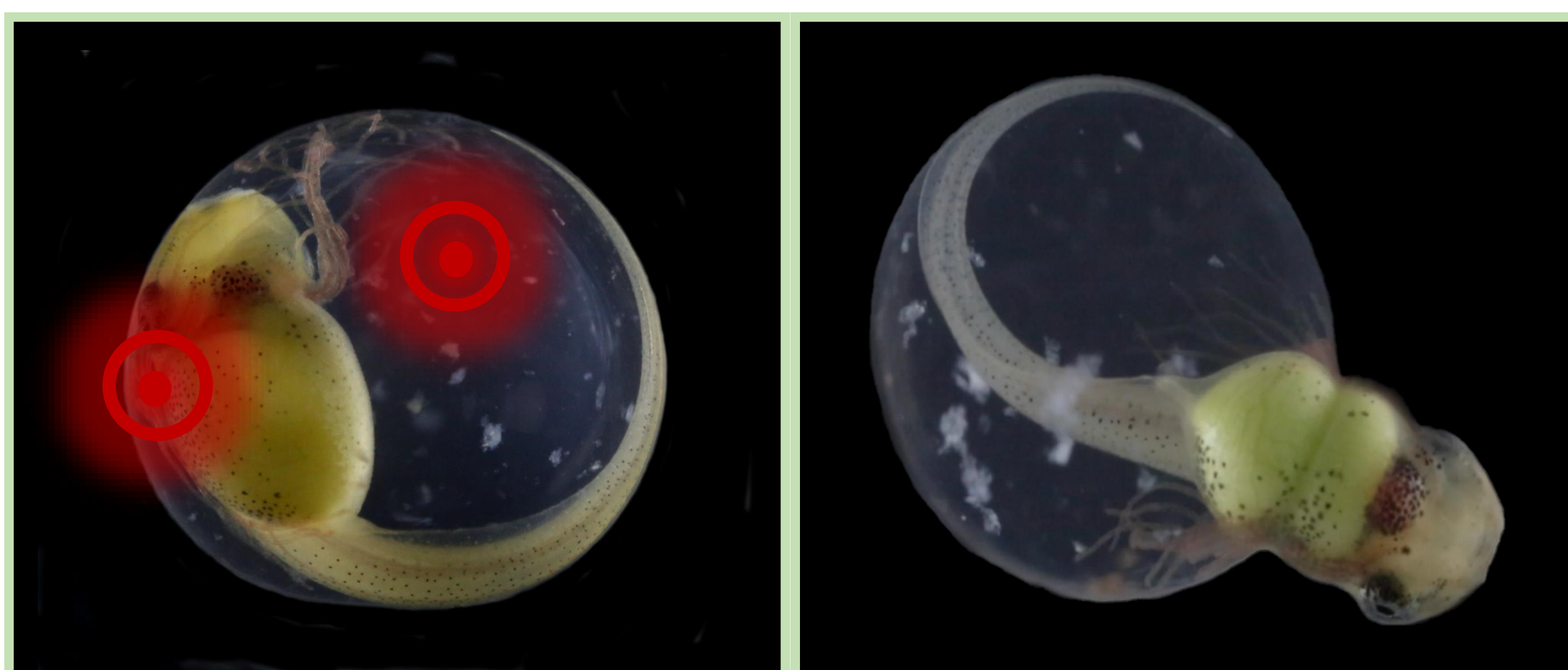
E1. 'scary' stimulus.

1–100 Hz  
0.5 s noise,  
1.5 s silence

E2. moderate stimulus.

1–250 Hz  
1 s noise, 1 s silence

E3. We applied tactile stimuli manually **directly** on embryos or **indirectly** on the membrane away from the body.



**2 TEST AGES: 5 days** – Midway through hatching period  
**4 days** – Near onset of predator-induced hatching

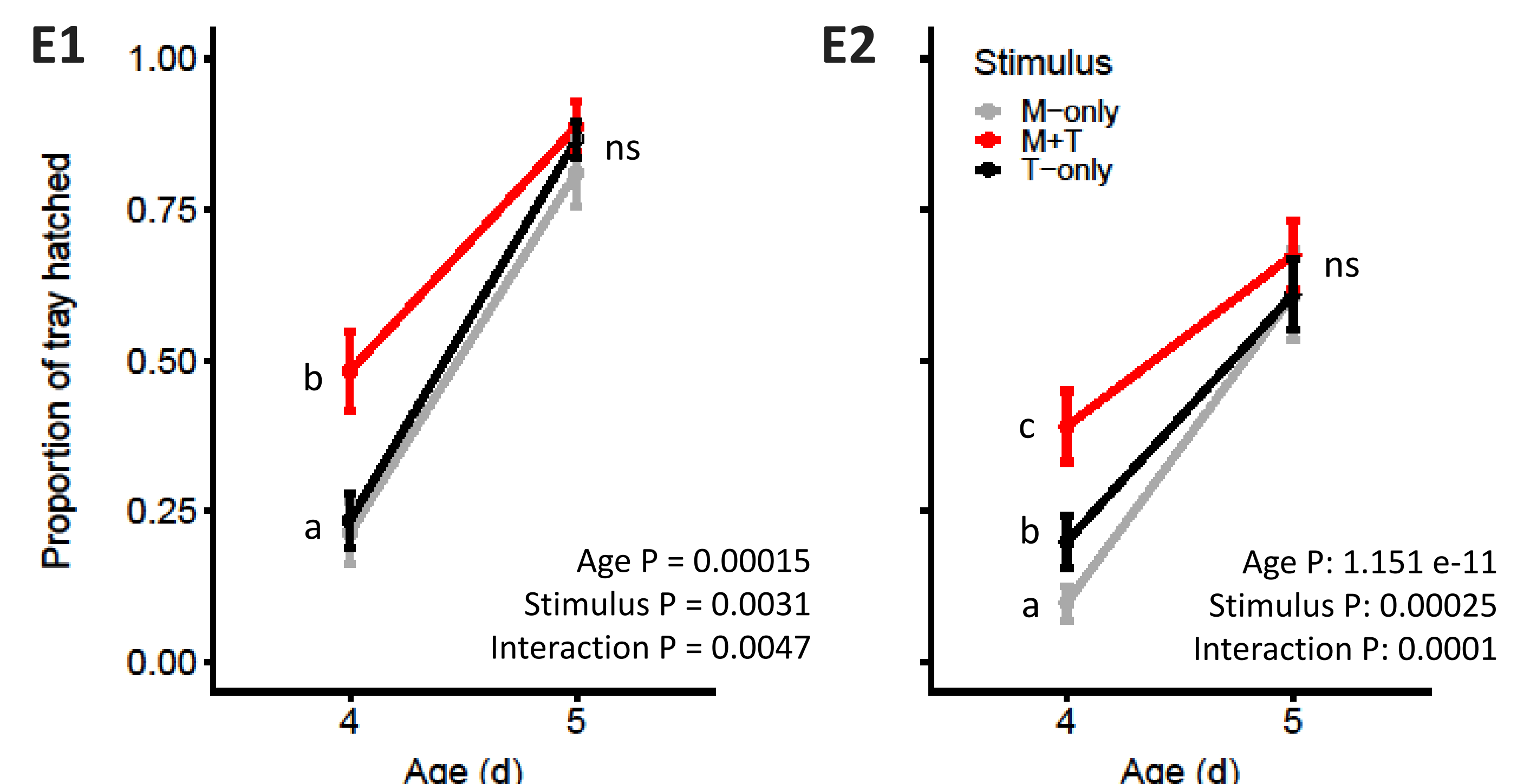
**Conclusion: Embryos use both motion and tactile cues to assess risk and show adaptive ontogenetic changes in how they combine information.**

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- Q1. Do embryos use motion cues, tactile cues, or both?  
Q2. If both, are modalities redundant or non-redundant?  
Q3. Does cue use change developmentally?

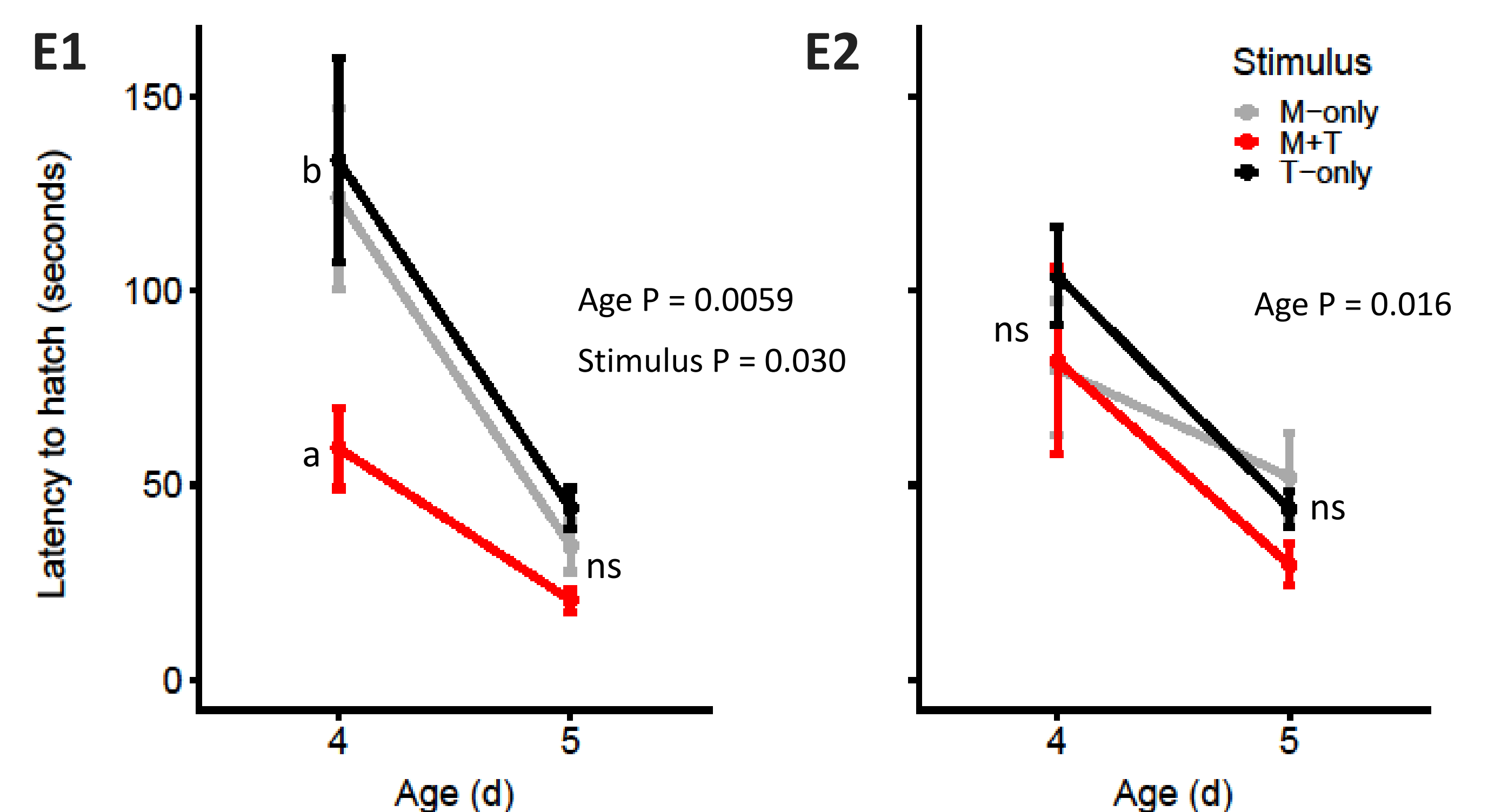
**H: Embryos use multiple mechanosensory cues and show adaptive ontogenetic changes in cue use.**

## Results and Conclusions



**Escape-hatching response to playbacks.** Both modalities elicited hatching. Bimodal stimuli elicited more hatching than either unimodal stimulus at 4 d embryos, but not at 5 d.

**Younger embryos treat motion and tactile stimuli as non-redundant risk cues; for older embryos they are redundant.**



**Latency to hatch in playbacks.** In both experiments, latency to hatching decreased with age. In E1 (more 'scary' stimulus) younger embryos hatched faster to bimodal cues.

**Younger embryos require more indication of risk before hatching, accumulated over time or across modalities.**

**Latency to hatch in response to localized tactile stimuli.** Both direct and indirect tactile stimuli elicited hatching. Younger embryos tolerated a longer period of indirect stimulation before hatching.

**Young embryos treat direct contact as more risky than indirect contact, but older embryos do not.**

