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Zebrafish larvae evade by swimming orthogonally to predators[1]
YUSHENG JIAO, University of Southern California, BRENDAN COLVERT, University of California, San Diego, YI MAN, University of Southern California, MATTHEW MCHENRY, University of California, Irvine, EVA KANSO, University of Southern California — Finding an efficient and effective evasion strategy is an age-old problem for prey survival. Existing theories suggest that it is preferable for prey survival to escape in a direction that either maximizes the minimal distance from a predator or is random and thus unpredictable. However, there is a lack of systematic studies accounting for both sensory processing and biomechanics of the prey during evasion. To this end, we build stocastic models combing both sensory and motor response noises for an array of evasion tactics, and assess their validity based on experimental data collected using larval zebrafish. Our evaluations show that moving orthogonal to the predator heading best explains the experimental observations, as it uses less sensory cues while giving same or better fits than the classic distance-optimal strategy. Moreover, predictions of the orthogonal strategy can be further improved by addressing the physical constraints in larval zebrafish: smaller turns are favorable for faster responses. Our results show that prey tends to adopt strategies that reduce perception complexity and is strongly influenced by its biomechanical capability. We conclude on the implication of our framework for deciphering the neuro-sensory motor mechanisms underlying other animal behaviors.

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Yusheng Jiao
Univ of Southern California

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