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Title
FishSim Animation Toolchain: an innovative tool pushing the boundaries of studies on fish
Behavior

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Abstract
Here I present the results of an interdisciplinary collaboration between biologists and computer
scientist at University of Siegen (Germany). Using an innovative approach combining 3D computer
animation and a robotic system, we developed the free and open-source *FishSim* Animation Toolchain
(short: *FishSim*). *FishSim* combines different tools for the design and animation of virtual fish stimuli,
as well as their presentation on screen during behavioral experiments. Even though *FishSim* was
specifically tailored for the study of mate-choice copying in sailfin mollies (*Poecilia latipinna*), its
framework can be adapted to other fish species and research questions as well. Using examples from
our own research, we show how visual information (e.g., morphology and behavior) may be
manipulated during experiments and we demonstrate the high degree of control and standardization
that can be achieved. Further, *FishSim* enables closed-loop interactions between virtual and live fish.
By implementing a 3D tracking system, we show that a virtual male can follow the position of a live
focal female on screen and perform courtship behavior according to predefined criteria. Overall,
closed-loop computer animation provides a more natural stimulus experience and paves the way for
the study of social communication, in which a virtual animal may respond to the behavior expressed
by a live counterpart in real-time.