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Conditioning your bee - in one, two, three!
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The honeybee has served as an important model species in studies of learning and memory for the past decades. A growing concern worldwide that honeybees suffer from a wide range of agrochemicals and diseases has led to increased effort in understanding the impact of these culprits at individual as well as on colony level. Despite the spike in interest, few attempts have been made to develop standardized assays where different aspects of behavior can be quantified. We recently developed a semi-automatic device for conditioning bees in a free-walking paradigm. This system, which we have named APIS (Automatic Performance Index System) is flexible, easy to operate and reliant. APIS consists of a rectangular conditioning chamber where individual bees can walk unhindered (but not fly) from end to end. A metal grid covers the interior surface through which weak electric pulses can be delivered. Airstreams carrying odors are connected to distal ends, and the odor stimuli as well as the electric pulse stimuli can be accurately controlled from a custom written software. The position of the bee is continuously sampled by infrared light sensors arranged along the length of the chamber. The history of the bees' movement is provided by the system readout, from which variables of interest can be extracted and analyzed. In an ongoing experiment we screen the effect of neonicotinoids at sub-lethal concentrations on honeybee behavior. Findings so far indicate that treated bees have difficulties with differentiating in their behavior towards a previously shock-reinforced odor and a neutral odor during a short-term memory test. These initial findings serve as examples of APIS as a powerful tool in screening the impact of chemicals by using measurements of learning and memory as proxies.