

# Measurement of Locomotor Activity in Rodents: Design of a Compact, Multifunctional, User-friendly and High Throughput System

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## ABSTRACT

Locomotor activity (LMA) is typically used as a primary screen for pharmacological characterization of novel compounds. This can be as either a side-effect profiling screen or in LMA-challenge tests thought to be predictive of therapeutic efficacy. As alterations in locomotory behavior can be induced by modulation of numerous neuronal networks and their associated neurotransmitters, LMA can be altered by a broad range of drugs such as neuroleptics, benzodiazepines, opiates, and psychostimulants. Current video tracking systems are essentially unlimited with respect to the number of arenas that can be monitored (e.g. Ethovision XT: up to 100 arenas). However, within the laboratory setting it is generally unfeasible to fully utilize this large capacity for rodent studies. As locomotor activity can be influenced by multiple environmental factors (test chamber properties, ambient light, temperature, noise etc), we aimed to develop and construct a compact, user-friendly, multiple chamber behavioral recording system utilizing Ethovision XT (Noldus Information Technology BV, Netherlands).

The setup was designed and constructed with key principles such as ease of use, multi-functionality, low cost and robustness. The system comprises of sixteen recording chambers that can house arenas of varying size and shape making it suitable for both rats and mice. Controllable light-emitting diodes above each chamber provide illumination (white light) at a controllable light intensity and in addition, dark-period recording is also possible as an infra-red

background illumination system was incorporated into the base of each chamber. This capability also permits tracking of animals with differing fur color. The system was designed such that cleaning between recording sessions is easy and its multifunctional design makes it possible to utilize the setup for different studies such as open field, light/dark box, marble burying, conditioned place preference and simple recognition memory tests.

To pharmacologically validate this new equipment, a series of pilot studies were conducted characterizing the effects of known hypo and hyper-locomotory agents that have been previously assessed in a standard beam-break LMA apparatus. Haloperidol (0.01-0.16mg/kg; s.c; 30 mins PTT) and amphetamine (0.31-20mg/kg; s.c; 30 mins PTT) was administered to NMRI mice (Charles River) and locomotor activity recorded for thirty minutes. As expected, both compounds elicited hypo-LMA (haloperidol) and hyper-LMA (amphetamine) effects that were in-line with historical data generated in the beam-break apparatus. Surprisingly however, there were important differences in both the magnitude of pharmacological-induced effects but



Figure 1. Experimental setup.

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perhaps more importantly a change in the sensitivity between detection of true LMA and stereotyped behaviors. For example, at higher doses of amphetamine where animals are clearly displaying stereotypic behaviors (sniffing, head weaving etc) the beam-break apparatus shows this as minimal LMA activity whereas the Ethovision detects this as LMA and therefore shows higher values.

In conclusion, we have designed, constructed and pharmacologically validated a novel, low-cost,

multifunctional, video-based LMA recording system that has significantly increased experimental throughput. Although, the preliminary pharmacological study has shown similarities between datasets generated in this new apparatus and historical studies, it has become apparent that due to subtle differences between beam-break and video-based recording systems, data may not always be comparable. Further development/calibration of this system may resolve some of these issues, but potentially improvements in the detection of LMA vs. stereotyped behaviors may require an acquisition system upgrade.