

Reanalyzing Explorative Behavior in the Open Field Test

New Insights from a New Application that Phenotypes Mice Exploratory Behavior

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The currently prevailing approach in behavioral phenotyping relies on a defined set of experiments which aim to find abnormalities in a given mouse strain or genotype [1]. Most of the experiments are simple to apply and provide a quantitative, or qualitative, score that can be used as a proxy for various functions such as anxiety, memory capabilities, sensory capacity, motor function and more [2,3].

The open-field (OF) represents one of the most popular tests to assess both locomotion and anxiety in rodents [2,4]. In this test, the animal is placed in an arena and its exploratory behavior is monitored. In its original setups, the assay included an arena with square markings on the floor and exploration was assessed by manually recording the animal's location at designated time frames. Nowadays, automated video tracking systems monitor the animal's location throughout the experiment and supply an output of accurate coordinates [5]. Yet, despite the detailed location these systems provide, most of the analyses include indices that relate to the center and border of the arena (time spent in center; number of visits to center, latency to first visit to the center and total distance traveled). The rationale is that the more a mouse explores the arena and/or the more time it spends in the center of the arena and/or the more frequently it visits the center of the arena, the less anxious it is considered to be.

This dependence on a simplistic distinction between center and border substantially reduces the precision of data analysis and may fail to detect differences between groups of animals of different genotypes or those which underwent different manipulations prior to testing. For example, variations in speed of movement while exploring the arena are rarely considered. In order to allow better phenotyping, we developed a new application for the analysis of mouse behavior in the OF. This application, termed *COLORcation*, relies on analyses of mouse exploration at a user-defined spatial resolution (up to 10 × 10 “tiles”) that provides a detailed color heat-map of activity.

The *COLORcation* application utilizes track and rearing files exported from different tracking systems (the presented data was generated from VideoMot2; TSE-Systems) to allow the user to perform a batch analysis of as many groups and mice as desired. The

batch analysis parameters may be defined by the user to include different indices, such as number of visits, cumulative duration in a specified location or rearing behavior (if such data is available); furthermore the user may define the number and size of the spatial “tiles” that subdivide the arena.

Figure 1 depicts *COLORcation* “heat-maps” exemplifying the impact of an anxiogenic pharmacological agent (FG7142, 5mg/kg) on the mouse activity in the OF. The “heat-maps” illustrate cumulative duration in each “tile” for each of the compared groups. Such a graphical representation offers an objective illustration of the group activity and may emphasize differences that otherwise would not have been detected in a classic track plot.

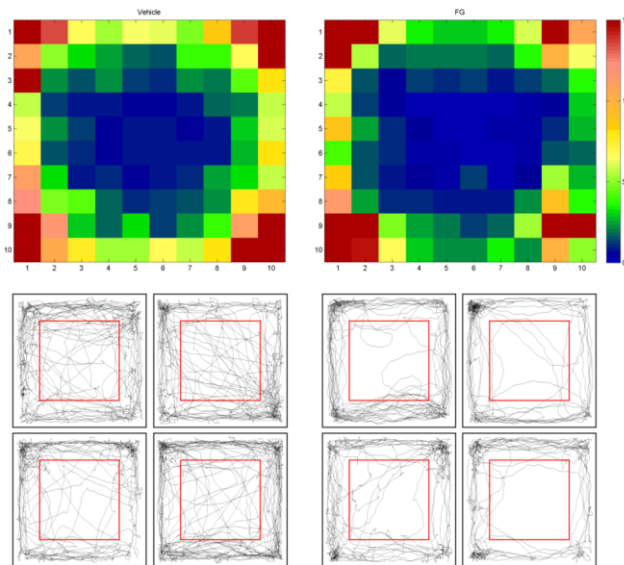


Figure 1. *COLORcation* heat-map representation. Open-Field activity of WT mice treated with either vehicle (left panels) or an anxiogenic agent (FG7142) (right panels) as depicted in groups heat maps (top panels) comprised of several tracks of individual mice from either group (bottom panels).

Further data will be presented exemplifying the impact of restraint stress on the mouse activity in the OF.

Ethical statement: all experimental procedures were approved by the institutional animal care and use committee; approval number 05270813-3.

References

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