Comparing touchscreen-based tests of pattern separation for rodent models

PRESENTER:
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BACKGROUND:

Touchscreen-based systems (*Figures 1, 2*) are designed to reduce the 'translational gap' between preclinical research and clinical application because the tests for rodents and humans are designed to be as similar as possible. Two touchscreen-based cognitive tests are designed to evaluate pattern separation: (1) the Location Discrimination (LD) task and (2) the Trial-Unique Non-Matching to Location (TUNL) task. In this study, we compare these two touchscreen-based tests of pattern separation.

METHODS

Animals

Two cohorts of C57Bl/6 mice were employed for behavioral testing. The initial cohort comprised 22 mice (12 female, 10 male), which underwent TUNL testing, while a subsequent cohort of 10 male mice underwent LD testing.

Touchscreen Chambers

Bussey-Saksida Touchscreen Chambers (Lafayette Instruments)

Initial Training

To ensure the mice remained motivated for behavioural testing, they were subjected to calorie restriction, maintaining them at 90% of their free-feeding body weight. The animals were housed in a reversed 12-hour light-dark cycle and tested during their dark phase. Both tests (i.e., TUNL and LD) involved a Basic Training Schedule that utilized operant conditioning techniques.

Comparison of the Tests

Upon completing the Basic Training Schedule, the animals progressed to the testing phase. A comparative analysis of the two tests was conducted, considering factors such as data quality, training duration, and level of difficulty.

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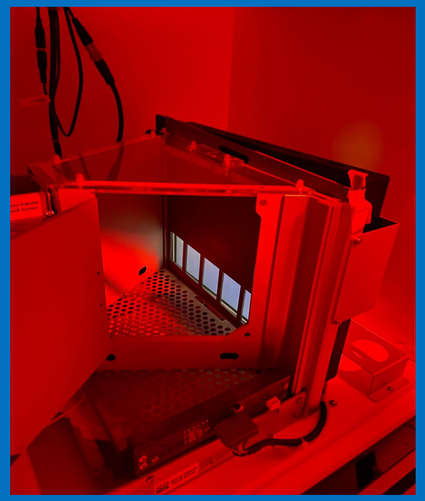


Figure 1

Figure 2

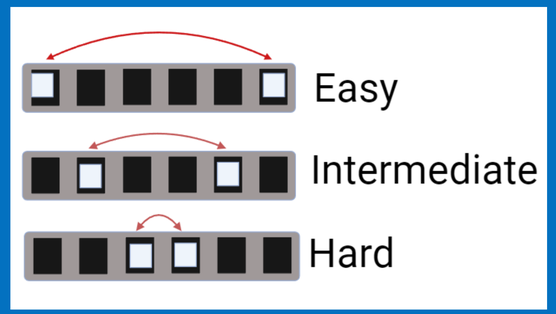


Figure 3

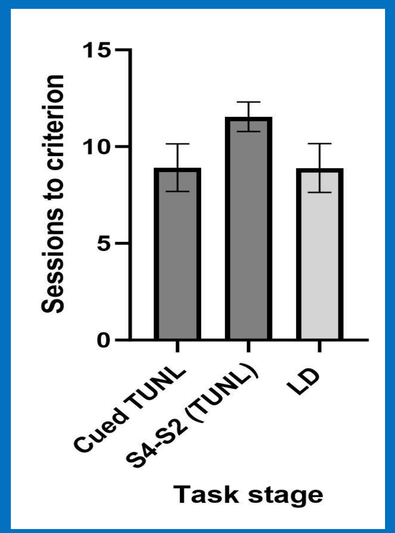


Figure 5

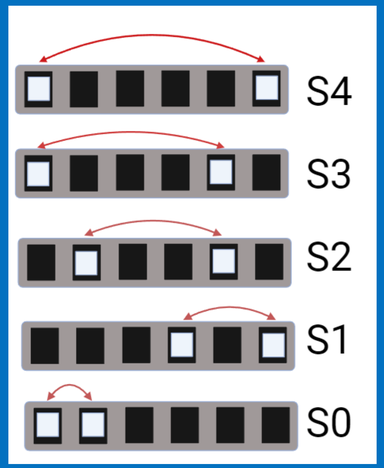
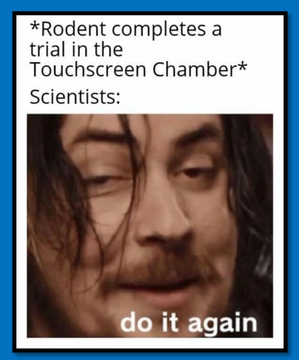


Figure 4



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RESULTS

Training Duration

The number of sessions required for training in LD (mean: 9, minimum: 5, maximum: 15) was found to be lower than in TUNL (average: 20, minimum: 11, maximum: 35), as illustrated in *Figure 5*. However, it is important to note that the training period for TUNL can potentially be shortened based on the chosen separation level.

Separation Levels/Difficulty

TUNL offers 5 separation levels (S4-S0, *Figure 4*), whereas LD presents 3 difficulty levels (easy-hard, *Figure 3*), with the intermediate level utilized for training. In LD, subjects are counter-balanced across two difficulty levels, whereas in TUNL, the separation level can be adjusted within a single session, adding a higher level of dynamism.

Data Quality

The Touchscreen Cognition Chambers software, ABETII, provides automated data such as correct percentage, session length, and correct/incorrect response latency for both LD and TUNL . Nevertheless, TUNL data can be analyzed based on separation level.

DISCUSSION

The comparison between Trial Unique Non-Matching to Location (TUNL) and Location Discrimination (LD) tests in C57Bl/6 mice reveals intriguing differences in training requirements and cognitive assessment methodologies. While the LD test demonstrates a shorter training period, potentially indicating quicker task acquisition, the TUNL test offers greater flexibility with its adjustable separation levels and dynamic testing environment. Furthermore, the ability to analyze TUNL data based on separation level provides nuanced insights into cognitive performance, enhancing the depth of behavioral assessment. These findings underscore the importance of considering specific experimental goals and the cognitive demands of each testing modality when designing behavioral studies in mice.

Acknowledgements

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