LONG-TERM DAILY TOUCHSCREEN TESTING ACTS AS A COGNITIVE ENHANCER IN MICE

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Background

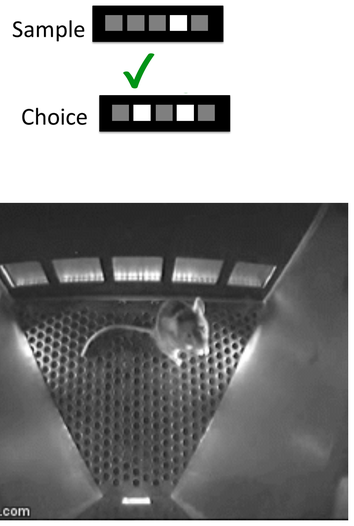
In this study, we set out to assess hippocampal dependant learning in the APP/PS1 mouse model of Alzheimer's Disease (AD). No cognitive deficits were evident in APP/PS1 mice at any age, contrary to previous reports using maze-based learning and memory tasks. We hypothesized that daily and long-term touchscreen testing training may have inadvertently acted as a cognitive enhancer. When touchscreen tested mice were assessed on the Morris water maze, they showed improved performance compared to naïve WT and APP/PS1 mice. In support of this theory, we show that touchscreen trained WT and APP/PS1 mice show increased cell proliferation in the hippocampus compared to behaviourally naïve WT and APP/PS1 mice.

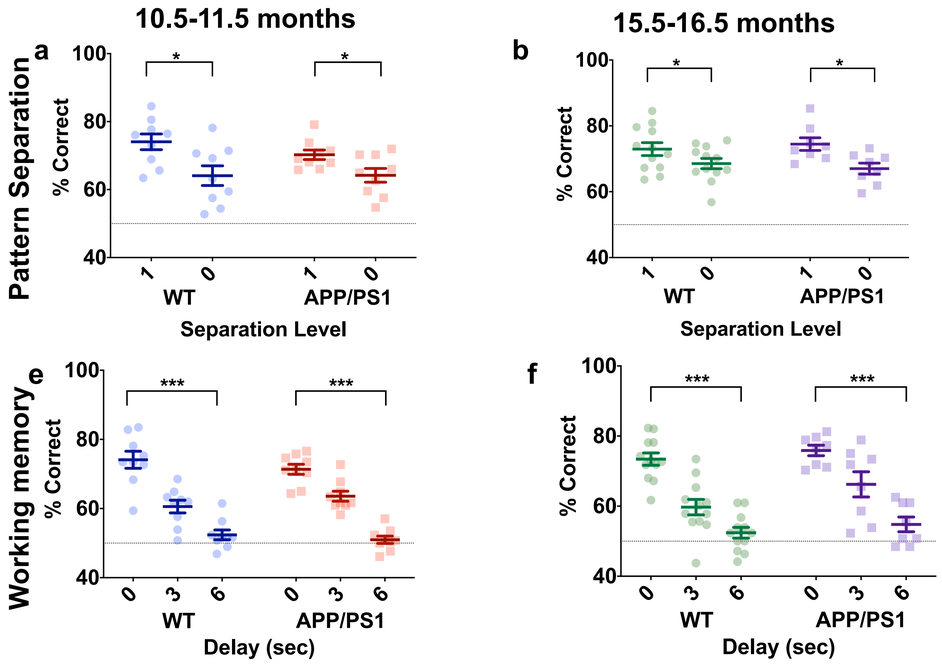
Methods

Animals, housing and pretraining. APPswe/PS1ΔE9 (APP/PS1, C1 n=9, C2 n=8) or wild-type littermate controls were housed in reverse-light cycle and from 8 months of age were food restricted to 85% free-feeding weight. Mice were habituated to Bussey-Saksida chambers, mice were trained through interactive steps to nose poke stimuli on touch-sensitive computer for strawberry milkshake reward (Nippy's LTD).
Order of testing. Cohort 1 (APP/PS1, n=9, WT n=9) were assessed on PAL and TUNL at 8 and 15.5 months, respectively. Cohort 2 (APP/PS1, n=8, WT n=12) were assessed on TUNL at 10.5 months and Morris water maze 12 months. Cohort 3 (APP/PS1, n=8, WT n=7) were not trained on touchscreens, nor food restricted, and were assessed on Morris water maze at 12 months of age.
Immunohistochemistry. Cohort 2 and 3 mice were euthanized by transcardial perfusion (4% paraformaldehyde) and brains processed for DAB IHC. The number of proliferating cells and immature neurons in the dentate gyrus were quantified by Ki67 and DCX staining.

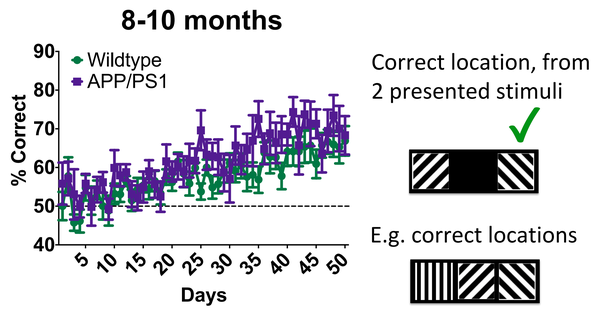
APP/PS1 mice show no impairment in hippocampal-dependent touchscreen tasks, up to 16 months of age

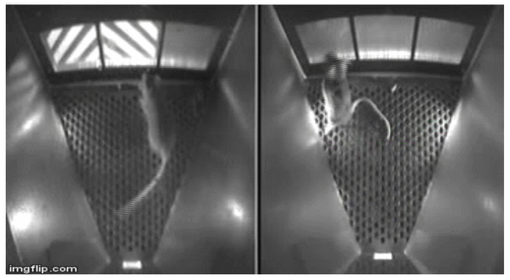
Trial unique non-matching to place (TUNL)





Paired associate learning (dPAL)

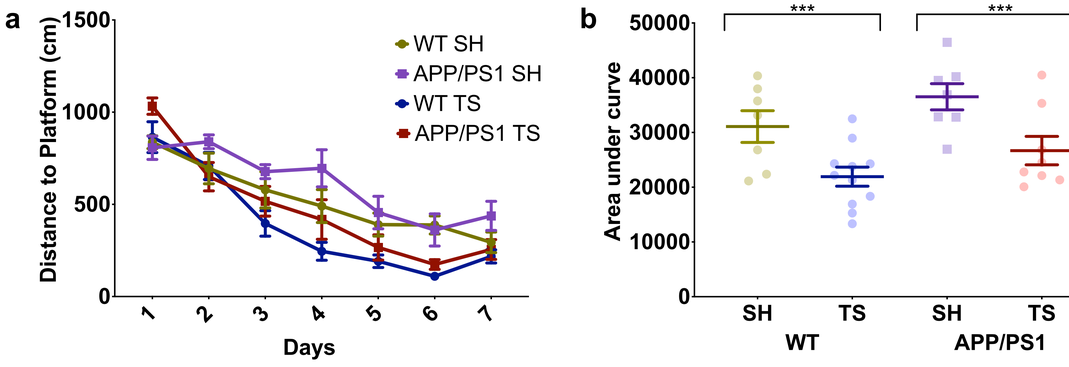




Zoom Space

Statistical analysis.
For MWM, repeated measures ANOVAs were used to analyse latency to platform and time spent in quadrant on the probe day. One-way ANOVA's were used to compare cell count data and area under the curve for MWM acquisition. Touchscreen data was analysed at the level of trial using generalised linear, latent and mixed models (GLLAMM) of regression.

Touchscreen (TS) trained mice show enhanced Morris water maze performance and increased hippocampal neurogenesis markers



Conclusions

Extended touchscreen training led to cognitive enhancement and increased proliferation and numbers of immature neurons in both WT and APP/PS1 mice.

Studies utilizing touchscreen technology should incorporate potential positive effect of touchscreen training on behavior and brains of experimental mice.