

# Play or stay? What rats really want

NIKITA McCOMBIE

Porton Down, UK

Correspondence: nmccombie@dstl.gov.uk

## Introduction

Studies on rodent behaviour and growth showed that rats in enriched cages showed longer durations of sleep and lower levels of agonistic behaviour compared to rats housed in cages with minimal enrichment.<sup>1</sup> This improvement was observed by both single housed animals<sup>2</sup> as well as rats housed in groups of five.<sup>3</sup> It was also noted for rats in both long and short-term housing.

Singly housed rats in super enriched cages showed increased indicators of good welfare such as sleep, exploration, movement and feeding behaviour. They demonstrated decreased indicators of poor welfare such as stationary behaviour and the relative weight of adrenal glands.<sup>3</sup>

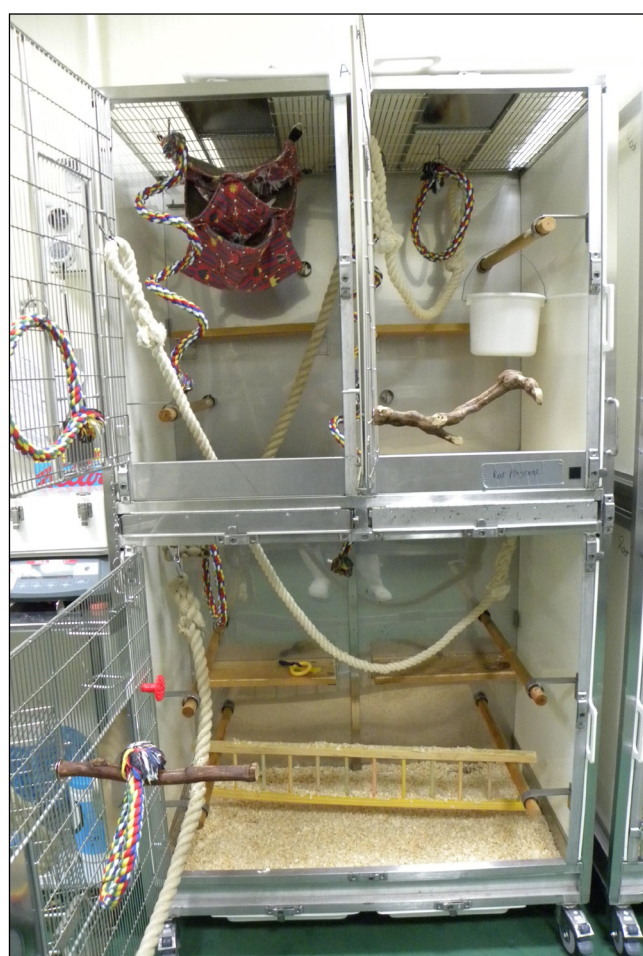
Over a 5-month period, 32 one-year-old female Lister-Hooded rats were housed in groups ranging from 4 to 6 individuals. A study was created using the process set out in protocol D<sup>4</sup> of evaluating environmental enrichment from the NC3Rs' website<sup>5</sup> to help understand what influenced the rats to use a play cage.

## Method

For eight days, the rats had access to both their home cage (170 × 85 × 67 cm; length (L) × depth (D) × height (H) ) and a play cage (98 × 60 × 180 cm; L × D × H). Observations were made daily to record which cage the rats occupied.

The play cage was positioned adjacent to the home cage and connected by a tunnel to provide the rats with unrestricted movement between the two environments. Data was collected using a motion sensor camera and the number of rats were recorded in the play cage at 00:00, 04:00, 08:00, 12:00, 16:00, 20:00.

Both the play cage and the home cage offered the same basic requirements, including tunnelling options, resting/sleeping areas, food and water. All other enrichment was either replicated with the same item or substituted with an item that satisfied the same positive motivation.<sup>6</sup>

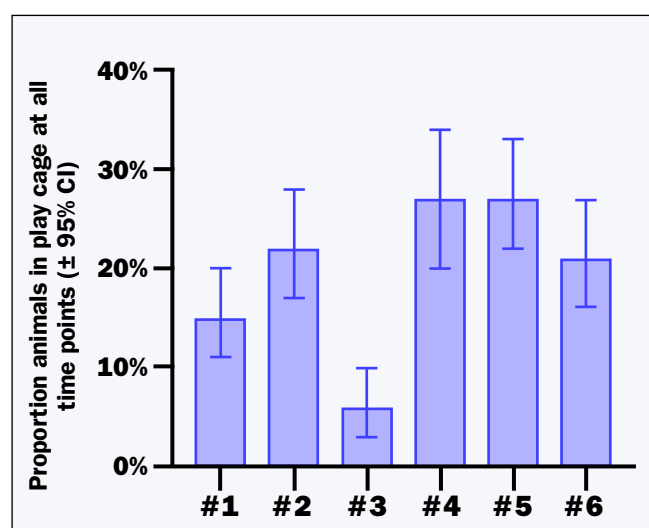


**Figure 1.** Play cages used in the study.

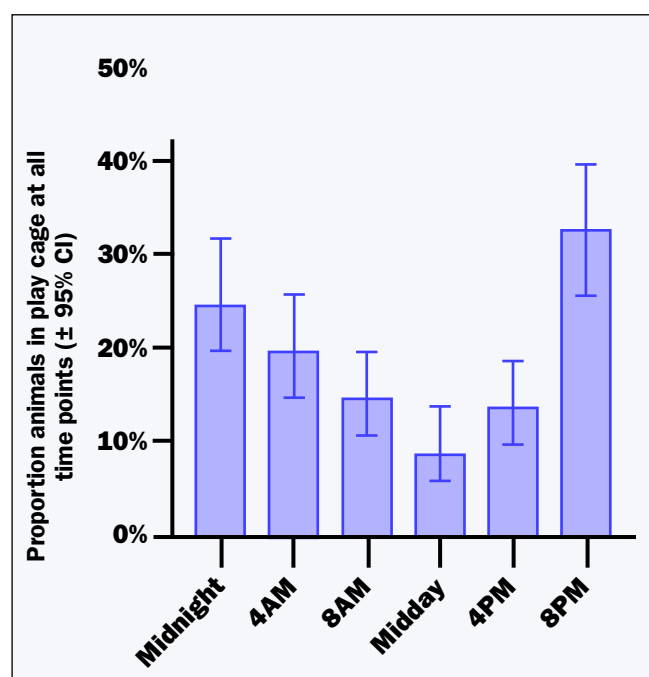
| Variance Source | Wald Chi-Square | Degrees-of-freedom | <i>p</i> |
|-----------------|-----------------|--------------------|----------|
| (Intercept)     | 51.144          | 1                  | < 0.001  |
| Time of day     | 47.845          | 5                  | < 0.001  |
| Day             | 1.078           | 1                  | 0.299    |
| Group           | 33.833          | 5                  | < 0.001  |

**Table 1.** Results of generalised binary logistic modelling.

For a *p* value less than 0.05, the likelihood of the data being random is less than 5%.



**Figure 2.** Graph showing the percentage of rats in the play cage per group.



**Figure 3.** Graph showing the percentage of rats in the play cage per time point.

## Observations

- The rats may have established behaviour patterns that could have influenced the data such as choosing to sleep in a specific location.
- Rats are nocturnal and expected the play cage was utilised more overnight.
- The camera setup was not optimal; there were blind spots in the play cage, so rats may have been missed and some time points did not trigger the camera.
- The rats were housed in large enriched cages already. This could have reduced the likelihood of the rats choosing to interact with the play cage especially for smaller groups as their needs may have already been satisfied.

## Results and discussion

This data was analysed using generalised binary logistic modelling, three factors were identified as potential testable influences towards time spent in the play cage (Table 1).

- Cage group – i.e. some groups of rats may have different attitudes towards adventure.
- Day – i.e. as the rats become more familiar with the extra play space they may use it more, or less.
- Time of day – i.e. the facility used more at different times due to established patterns of behaviour or being nocturnal.

Group 3 used the play cage less than all other groups (Figure 2) and the analysis identified a strong likelihood of differences between groups ( $p < 0.001$ ). This variation may reflect differences in group size or individual behavioural traits of the rats.

There was no evidence for any trend in play cage use over the 8 days of observations ( $p < 0.299$ ).

Time of day had a statistically significant influence on play cage use (Figure 3,  $p < 0.001$ ). Use was lowest at midday and highest at 20:00, consistent with the nocturnal activity patterns of rats.

## Conclusion

Group differences were evident with group 3 using the play cage significantly less than the other groups. Therefore group size should be explored further as this was the main variable within this statistic.

No trend was observed in the play cage use across the eight-day observation period, indicating that familiarity with the play cage did not influence use.

Time of day had a statistically significant impact on play cage use. These findings suggest that providing access to enrichment opportunities such as play cages during the evening and overnight periods will maximise their use and welfare benefits.

Overall, the results highlight the importance of considering both group composition and timing when implementing enrichment strategies for laboratory rats. Future studies should explore the role of individual differences and group dynamics in shaping enrichment preferences.

## Acknowledgments

I would like to thank the animal care team, NVS, statisticians and the working animals' fundamental science team for their help with the creation and set up of the study and poster.

## References

- <sup>1</sup> **Abou-Ismaïl, U.A., Burman, O.H.P., Nicol, C., Mendl, M.M.** (2010). Effects of enhancing cage complexity on the behaviour and welfare of laboratory rats. <https://www.sciencedirect.com/science/article/pii/S0376635710001890>
- <sup>2</sup> **Abou-Ismaïl, U.A., Mahboub, M.D.** (2011). The effects of enriching laboratory cages using various physical structures on multiple measures on welfare in singly housed rats. *Laboratory Animals* Vol. 45, 145–153.
- <sup>3</sup> **Lidfors, L., Wichman, A., Ewaldsson, B., Lindh, A-S.** (2014). Enriched cages for groups of laboratory male rats and their effects on behaviour, weight gain and adrenal glands. *Laboratory Animals* Vol. 48, 36–49.
- <sup>4</sup> **Protocol, D.** Mouse preference test NC3Rs' website.
- <sup>5</sup> <https://nc3rs.org.uk/3rs-resource-library/evaluating-environmental-enrichment/example-enrichment-study-protocols>
- <sup>6</sup> **Kirkden, R.D., Pajor, E.A.** (2016). *Applied animal behaviour science* 100 (2006). 29-47. Elsevier: Oxford. Using preference, motivation and aversion tests to ask scientific questions about animals' feelings. [Using preference, motivation and aversion tests to ask scientific questions about animals' feelings - Center for Zoo Animal Welfare](#)