**Elo-rating Model**

In addition we characterize the social dynamics within a group of mice by following

the sequence of wins/losses from chasing/being chasing interactions during the time.

The El-rating model was used to monitor dynamic changes in the individual social status of each mouse throughout the entire experimental period (7 days). At the beginning of the rating process, each individual starts with a predefined rating, for example a value of 1000. After each interaction, the rating of the 2 participants are updated according to the outcome of the interaction: the winner gains points and the loser loses points. The number of points gained and lost during one interaction depends on the expected score of the outcome (i.e. the probability ***p*** that the higher-rated individual wins) prior of the interaction. This means that expected outcomes lead to smaller changes in ratings than unexpected outcomes (VRIES, 2001), (Christof Neumann a, 2011).

For events where the previously higher-ranked individual wins:

***New rating of Winner = Old rating of Winner+ (1-p)×k***

***New rating of Loser =*** ***Old rating of Loser- (1-p)×k***

For events where the lower-ranked individual wins (against the expectation):

***New rating of Winner = Old rating of Winner + p×k***

***New rating of Loser = Old rating of Loser - p×k***

The value of p, defined as the probability of a mouse to become the winner in the interaction with another mouse, was calculated from the difference of the respective Elo-ratings by following a sigmoidal or logistic function:

For Elo-rating difference > 800 ***p***=1. The k is a constant and influences the speed with which Elo-ratings increase or decrease. As reported before we used an initial rating value of 1000 for each mouse and k=100 (Christof Neumann a, 2011).

The Elo –rating per mouse was represented as a function of the interaction events as well as a function of the days by considering the last event of each day.

In order to validate the differences in the dynamics of the Elo-rating among the group of mice, we performed 1000 randomizations of the chasing/being chasing (win/loss) events by shuffling the given interactions. In this way, the significance between the deltas or differences in the Elo-rating per day for each pair of mice was determined by comparing the value given by experiment with the delta distribution from the randomizations. By assuming a normal distribution of the deltas a p-value was calculated for each pair of mice and day with a significance level of p<0.05.

All the analysis was developed in Matlab.

**Stability index**

Elo-rating also allows the characterization of ranking or hierarchical stability during the time for each mouse. To quantify the degree of ranking stability during a given period we adapted to our experiment the stability index proposed by Neumann el.al. (Christof Neumann a, 2011) as:

defined for each mouse, where is the absolute difference between rankings as determined by the Elo-rating of 2 consecutive days, is a weighting factor determined by normalization of the Elo-rating with the highest – ranked individual, before ranking changes occured. Typically S ranges between 0 (completed instability of the rank) and 1 (completed stability of the ranking). The stability index was computed for periods of 1 day as well as for the whole experience.

All the analysis was developed in Matlab.

**Determination of social hierarchy**

**Another obsevations**

-The ranking was arranged according to the mean of each mouse along all the experiment day.

**References**

Christof Neumann a, b. J. (2011). Assessing dominance hierarchies: validation and advantages of progressive evaluation with Elo-rating. *Animal Behaviour*, 1-11.

VRIES, P. C. (2001). Elo-rating as a tool in the sequential estimation of dominance strengths. *ANIMAL BEHAVIOUR*, 489.