Research article

Discovery of recurring behavioural sequences in Wistar rat social activity: Possible support to studies on Autism Spectrum Disorders

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HIGHLIGHTS

- T-pattern analysis was applied to interactions of Wistar rats tested in open field.
- Recurring sequences of events were identified in rat interactive behaviour.
- 221 different t-patterns classified in four different categories were evidenced.
- T-patterns analysis may represent a potential aid for the study of ASDs.

GRAPHICAL ABSTRACT

T-pattern analysis, applied to the study of social interaction in rats, revealing the existence of four different categories of qualitatively different t-patterns.
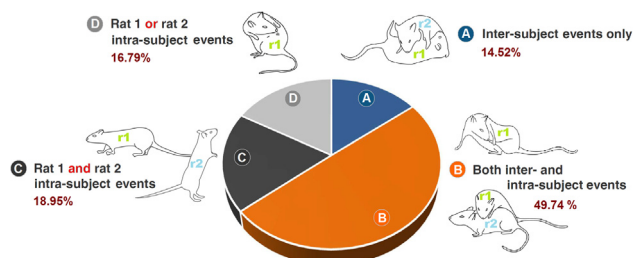
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ABSTRACT

This study was undertaken to investigate whether, in rat interactive activities, recurring sequences of behavioural events might be identified and how and to what extent each component of the pair is involved. To this aim, the multivariate temporal-pattern (t-pattern) analysis was applied to the social interactions of 9 pairs of male Wistar rats tested in open field. Interactive activities were classified into intra- and inter-subjects. Quantitative evaluations showed that intra-subject behavioural elements represented 62.37% and inter-subject ones 37.63% of the comprehensive behaviour. T-pattern analysis revealed the presence of 221 different t-patterns organized in four different categories: containing exclusively inter-subject elements; containing both inter- and intra-subject elements; consisting of rat 1 and rat 2 intra-subject elements and, finally, consisting of intra-subject elements carried out by one of the two subjects. Results show that the activity of two interacting Wistar rats is structured on the basis of several recurring temporal sequences. Moreover, social interactions appear to be expressed also by t-patterns where the behavioural elements are carried out by animals seemingly not interacting. A support of t-pattern analysis to studies on Autism Spectrum Disorders is proposed.

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1. Introduction

Many psychiatric disorders like depression, schizophrenia, autism and anxiety are strongly characterized by impairments in social interactions [1]. An animal model to study interactive

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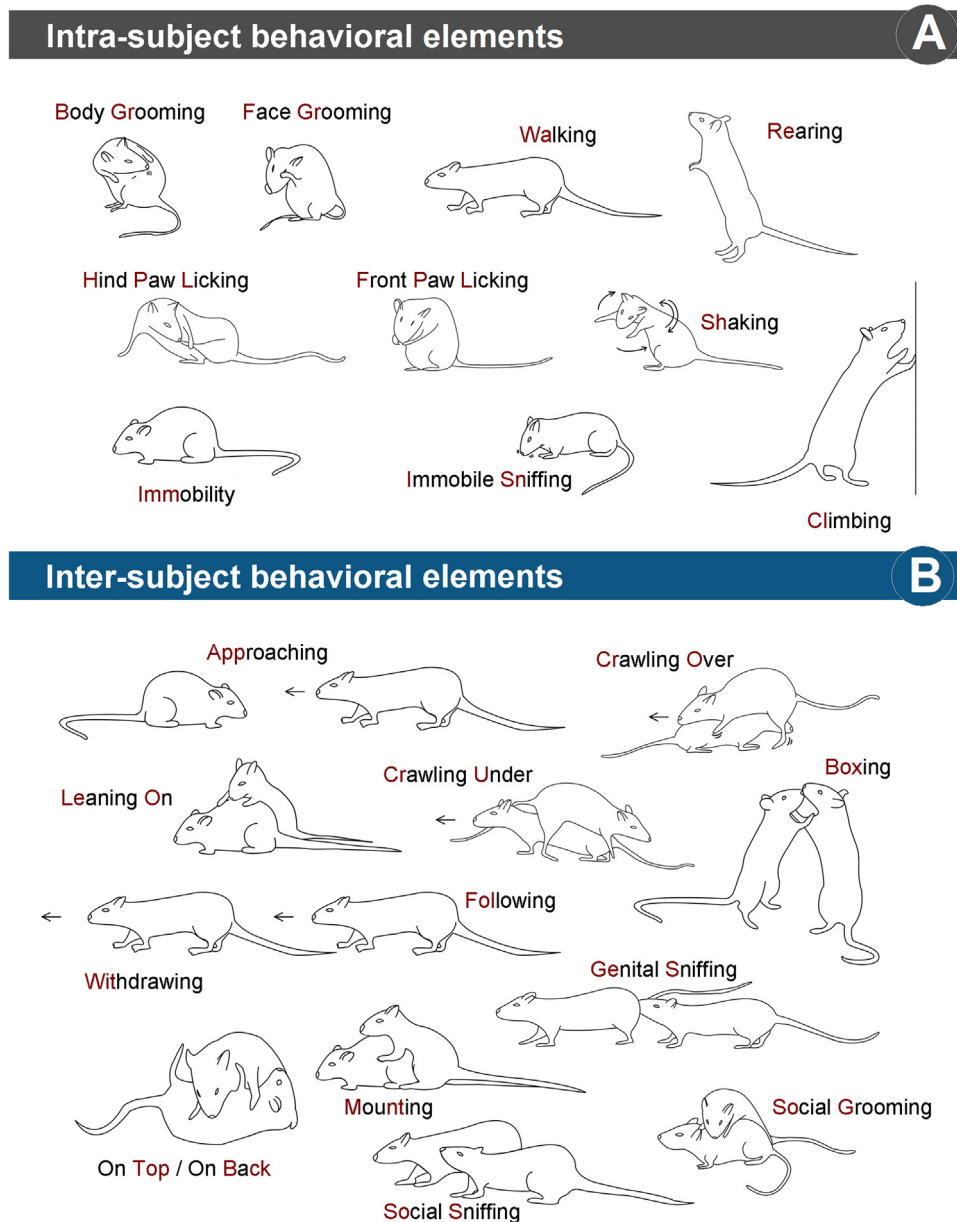E-mail address: giuseppe.crescimanno@unipa.it (G. Crescimanno).

Fig. 1. Ethogram illustrating social interactions in Wistar rat.

behaviour and its disorders is the social interaction test consisting in the observation of two rodents free to move in open field [11,12,14,20,23]. The analysis of latencies and durations of single behavioural elements has produced a vast amount of quantitative data but also left unexplored the structure of the relationships the whole interactive behaviour consists of. To shed light on the organization of the interactive behavioural repertoire, a valuable improvement is represented by the study of the relationships among the different components of the behaviour and, in particular, by the analysis of its temporal arrangement. Since the temporal architecture of social activities is, up to now, poorly understood, aim of present research was to investigate whether in the social interactions recurring sequences of behavioural events could be identified and how, and to what extent, each component of the pair is involved. To this purpose, a temporal pattern (t-pattern) analysis has been applied to the study of the social interactions of pairs of male Wistar rats tested in open field. T-pattern analysis is a multivariate approach developed to determine whether two or more behavioural events occur sequentially, recursively and with significant constraints on the interval lengths separating them [8,10,18,19]. In recent years, t-pattern analysis has been successfully used in several studies providing interesting insights on the temporal structure of different human and not human activities [3–7,15–17].

A preliminary account of the results has been presented elsewhere [9].

2. Method

2.1. Subjects

Eighteen male specific pathogen-free Wistar rats (Harlan Laboratories, Italy), 55–60 days old and weighing 220–250 g, were used for this study. Animals were housed in a thermo-regulated room maintained at a constant temperature of $23 \pm 1\,^\circ$C, under a 12 h light/dark cycle (lights on 07:00 a.m.; lights off at 07:00 p.m.). Food pellets (standard laboratory diet, Mucedola, Italy) and water were available ad libitum.