TIME-VARIABILITY OF ACCELERATION IN DYNAMIC EXERCISES

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INTRODUCTION

- The dynamic behaviour of a collective variable informs about the temporal couplings between the system components, and the ability of the system to regulate and control its goal directed behaviour. Changes in the time variability structure of collective variables have revealed a lost of fine regulation and control during quasi-static exercises when approaching exhaustion (Hristovski & Balagué, 2010; Vázquez, Hristovski & Balagué, 2016).

OBJECTIVE

- Detect the qualitative changes in the variability of acceleration (collective variable) in two different competitive dynamic exercises.

METHODS

2 experiments

✓ Eight experienced runners (39.37 ± 6.19 y.o) run a Cooper Test on covering the maximum distance in 12 min.

✓ Ten ski mountaineering athletes (5 males and 5 females; 25.8 ± 5.3 y.o) competing at international level performed a trial vertical race (1980 m of distance and 415 m of positive gain).

DATA ANALYSIS

- Acceleration was recorded using WIMU devices (Realtrack Systems SL, Almería, Spain) placed on L3 with a sample frequency of 100 Hz.
- RPE was recorded in runners at the end and HR was continuously monitored in both experiments.
- The time series of acceleration were analysed through *Multifractal Detrended Fluctuation Analysis* (MFDFA), on the first and last minute for the runners experiment and during all the time series for the ski mountaineers' experiment (divided in three portions).
- The initial and final value of the MFDFA spectrum were compared through the Wilcoxon non-parametric test.

RESULTS

	Runners (n=8)	Male skiers (n=5)	Female skiers (n=5)
Initial MFDFA spectrum	0.37 ± 0.24	0.30 ± 0.06	0.49 ± 0.24
Initial velocity (m/s)	4.10 ± 0.31	1.39 ± 0.04	1.22 ± 0.07
Final MFDFA spectrum	0.19 ± 0.05	0.53 ± 0.17	0.47 ± 0.10
Final velocity (m/s)	3.79 ± 0.27	1.48 ± 0.07	1.12 ± 0.04

Table 1. ◀ Mean and Standard Deviation of initial and final MFDFA spectrum and velocity for runners and ski mountaineering athletes.

- In the running study, those who approached exhaustion (RPE ≥ 9, HR ≥ 180) showed higher reduction in MFDFA spectrum at the end of the test.

- Some skiers showed a small increment of MFDFA spectrum (Table 1), probably due to a lower slope and an increase of velocity in the final part of the trial.

Although a reduction in the MFDFA spectrum was observed in some athletes during the exercise, no significant differences were found between the first and the last part of the trials in both experiments. The reduction in the variability of acceleration suggests a worse adaptability to the task demands over time and hence, a more difficult control.

CONCLUSIONS

The time-variability of acceleration seems to provide a valid information about the system adaptation during exhausting dynamic exercises. More evidences are needed to model the way the collective variable changes its behaviour and how the system loses its control as a consequence of fatigue during exercise.

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