

# High correlation and predictive value between alertness measured by reaction time and physical performance

Marc Therrien<sup>1,2</sup>, Marie-France Hébert<sup>3</sup>, Daniel Gartenberg<sup>4</sup>, Joseph De Koninck<sup>3</sup>, Geneviève Forest<sup>5</sup>

<sup>1</sup>Neuro Summum, Gatineau, QC, Canada, <sup>2</sup>Neurologie, Centre de Santé et de Services Sociaux de Gatineau, Gatineau, QC, Canada,

<sup>3</sup>École de psychologie, Université d'Ottawa, Ottawa, Ontario, Canada, <sup>4</sup>Department of psychology, human factors and applied cognition, George Mason University, Fairfax, Virginia, USA,

<sup>5</sup>Département de psychoéducation et de psychologie, Université du Québec en Outaouais, Gatineau, QC, Canada

## Introduction

Reaction time is often used to evaluate decreased alertness associated with sleep deficiency. No clear correlation between alertness levels and physical performance has been demonstrated due in part to complex methodology requirements. Reaction time tests on a smartphone now facilitate the evaluation of these relationships.

## Objective

The aim of this study was to look at these correlations for a subject executing repeatedly the same motor tasks in different alertness states and time windows over more than 2 months.

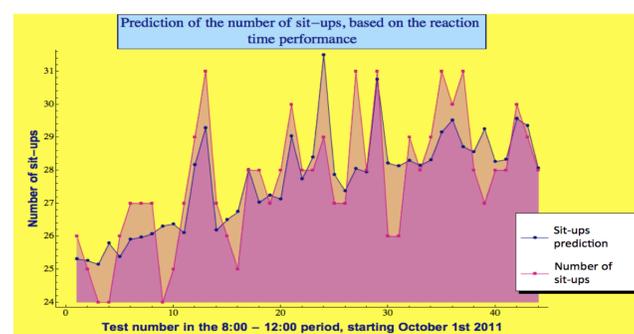
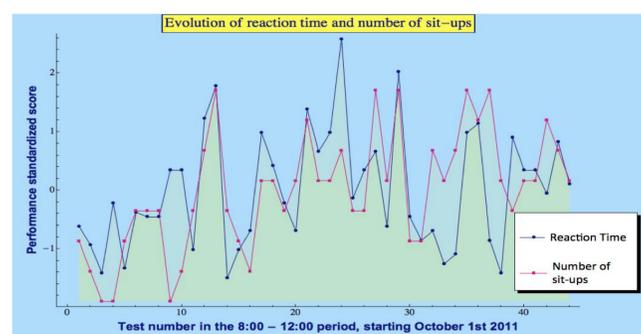
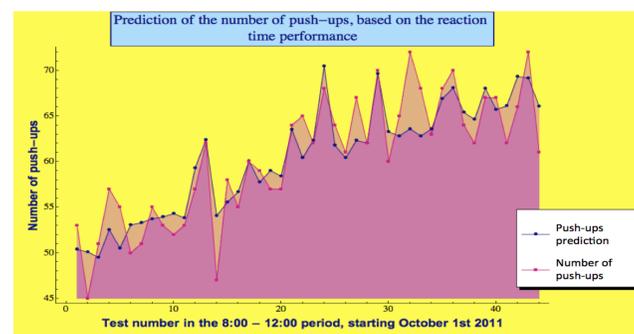
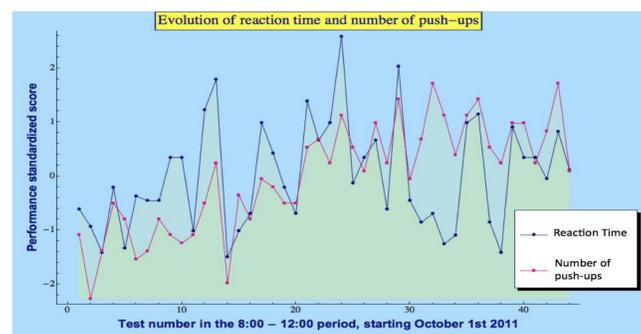
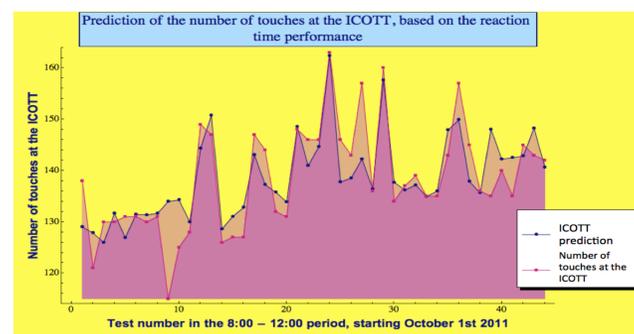
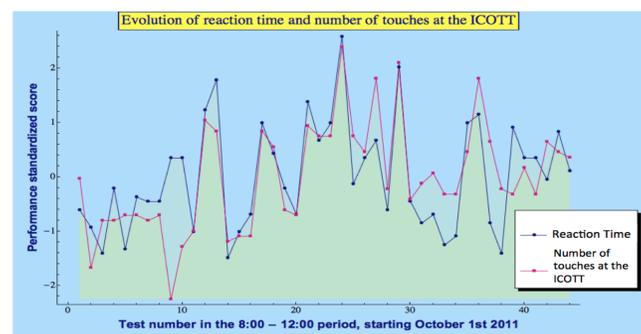
## Method

A 40 year old male executed a 3 min. reaction time test on a smartphone followed by maximal Push-ups, Sit-ups and touches at the Ipsilateral Contralateral Overhead Touch Test (ICOTT) over 1 minute each. Testing done up to 5 times per day in different time frames started March 1st 2011. Analyses were calculated from October 1<sup>st</sup> to December 6<sup>th</sup> 2011. Pearson's correlations and linear regression based predictions were calculated between the mean reciprocal reaction time scores and all 3 tasks independently for the 8:00AM-12:00AM time frame.



## Results

Mean reciprocal reaction time scores were correlated with the number of touches at the ICOTT ( $r=.73$ ,  $p<.001$ ), push-ups ( $r=.48$ ,  $p<.005$ ) and sit-ups ( $r=.50$ ,  $p<.001$ ). With minimal non-linear transformation to adjust baseline reaction time score to the physical performance learning curve, reaction time test results predicted the physical performance results with a mean prediction error of  $\pm 4.4$  (range of 48) for the number of touches at the ICOTT,  $\pm 2.5$  (range of 27) for the number of push-ups and  $\pm 1.0$  (range of 7) for the number of sit-ups.



## Conclusion and Discussion

These results suggest that alertness levels and physical performances are highly correlated. Moreover, alertness levels measured with a reaction time test on a smartphone was a good predictor of physical performance.

The implications of being able to optimise physical capacity by measuring and improving alertness naturally through sufficient sleep are important. For this subject, tiredness feeling disappeared approximately halfway between lowest and highest reaction time scores (results not presented here), suggesting that sleeping sufficiently to get rid of daytime tiredness is insufficient to reach peak performances.

Additional analyses for other time frames and periods recorded and corrections for many other variables recorded throughout this project are needed to support these findings.

## Acknowledgement

We are grateful to the subject's wife and children for their support in the realization of this project.

## Contact information

Marc Therrien MD, FRCPC (neurology)  
Email: marctherrien@videotron.ca