

Alertness Measured by Average Reaction Time on a Smartphone Predicts Physical Performance: Implications for Sleep Quality

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Introduction

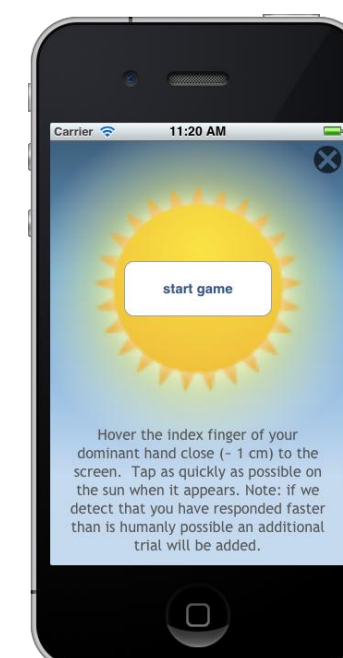
- It is established that the psycho-motor vigilance task (PVT) results are linked to sleep quality.
- The PVT measured by average reaction time (RT) over 3 or 10 minutes has been validated as a good measure of alertness. Now an average reaction time (RT) over 3 minutes can be obtained with an iPhone.
- Alertness measured by average reaction time (RT) over 3 minutes has also been shown to be highly correlated to physical performance.

Objective

- The present study aims to validate a prediction model of physical performance to determine if a 3 minutes average reaction time test can predict physical performance and this by testing

Methodology

- A 40 year old male executed a 3 min. reaction time test on a smartphone consisting of 18 trials with irregular intervals.
- RT was 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 extended for 14 months from March 1st 2011 to May 1st 2012.



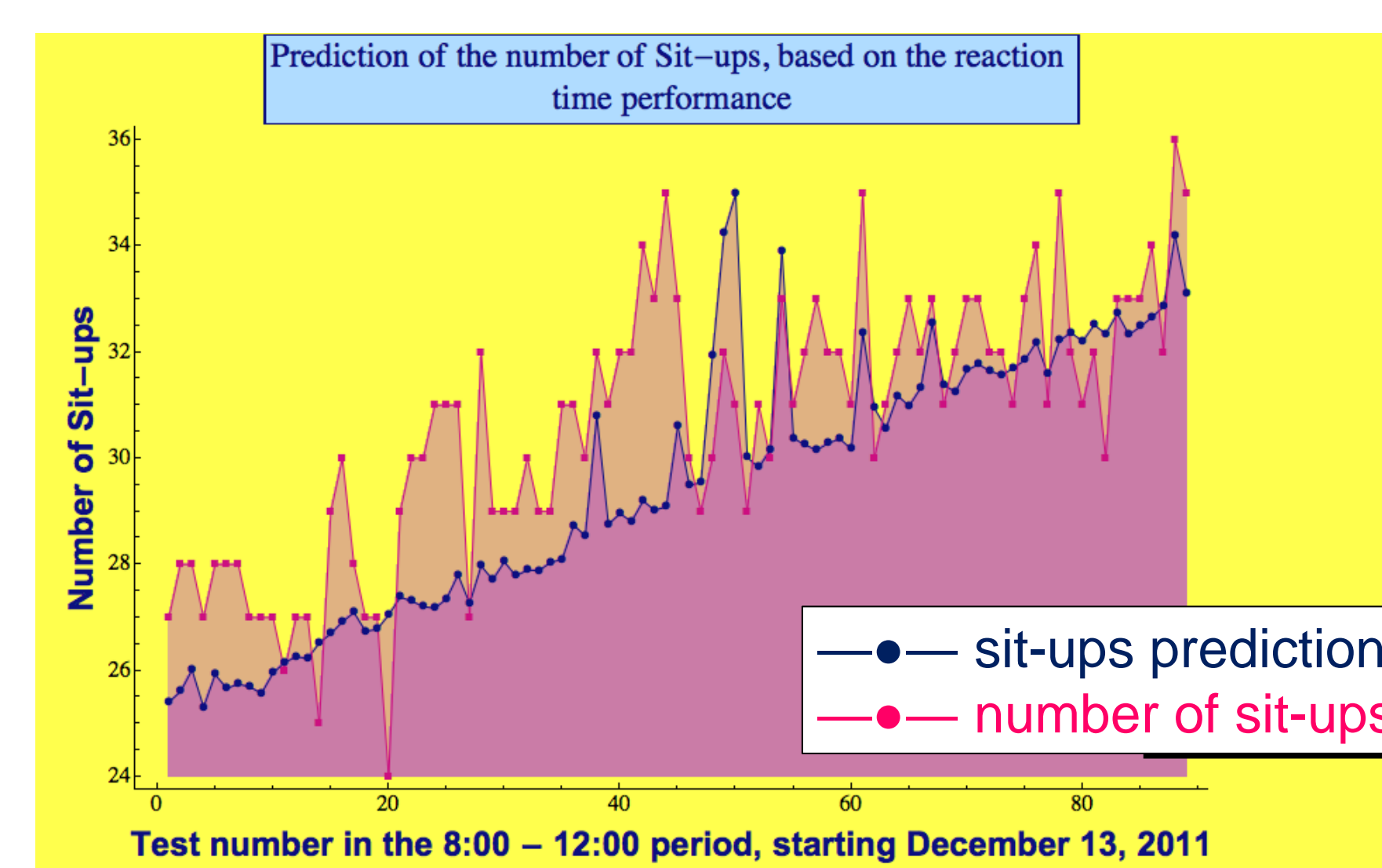
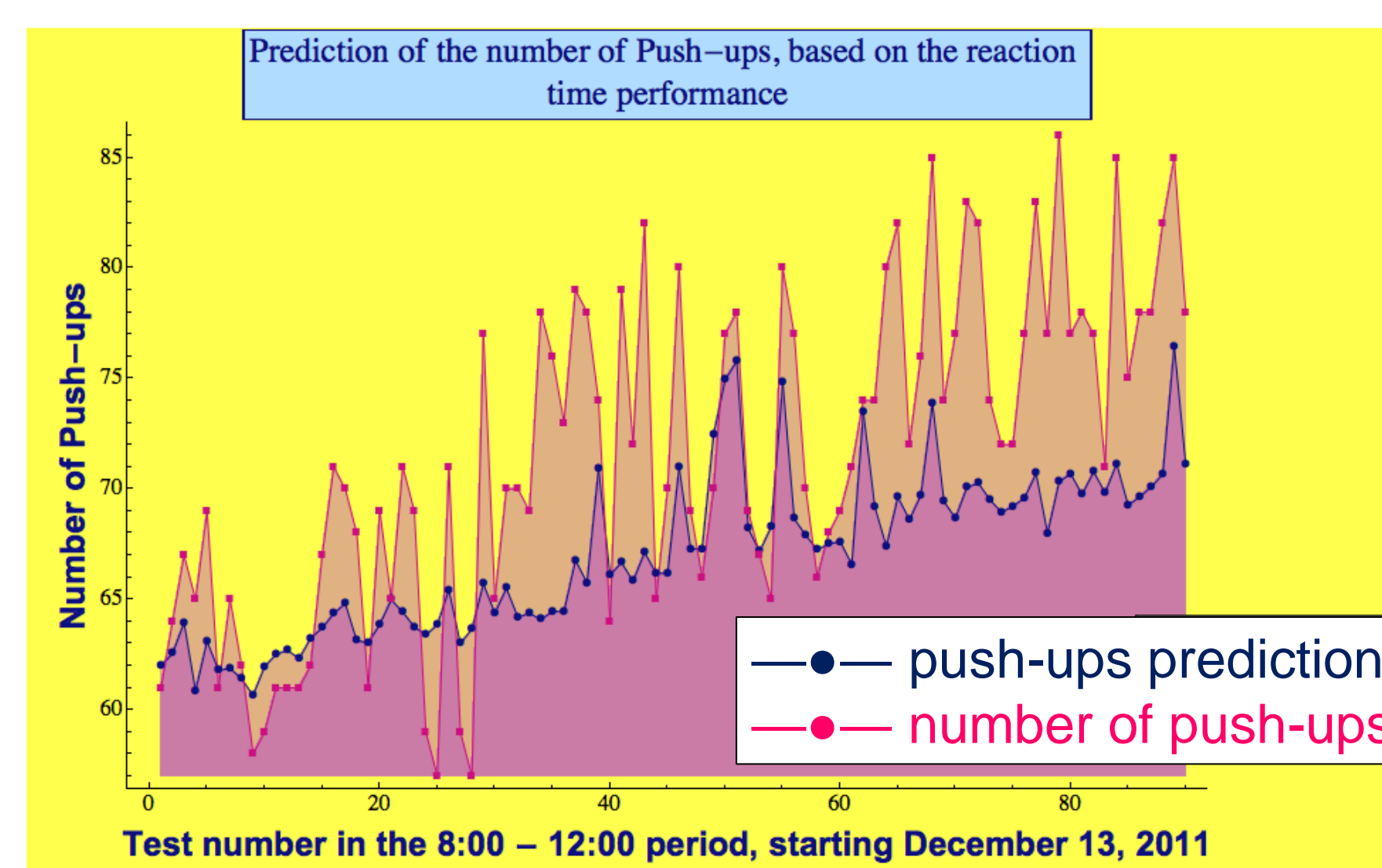
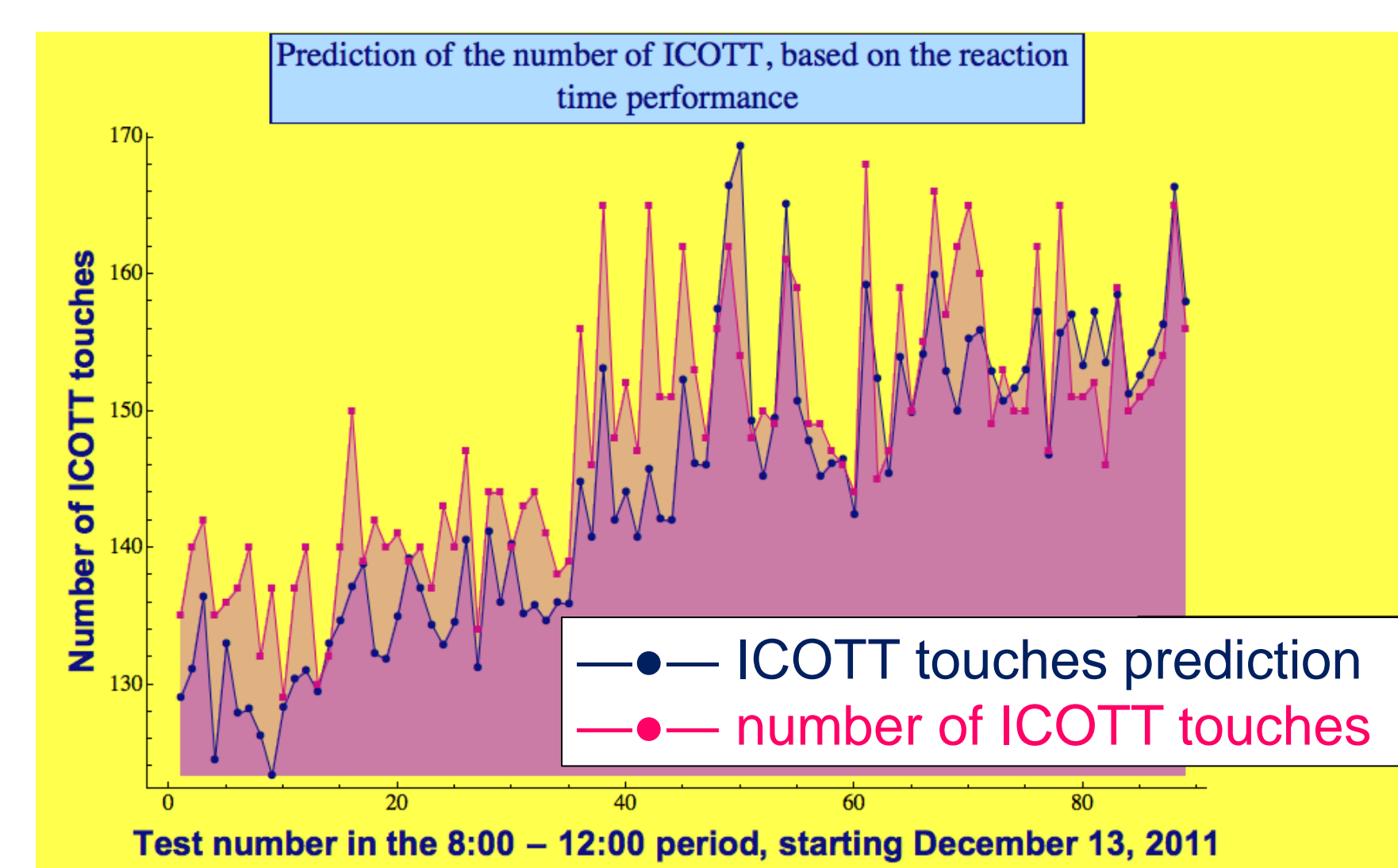
Methodology

- The equation is built from 44 scores obtained from the RT and the associated 3 physical tasks in the 8:00AM-12:00AM time frame from October 1st to December 6th 2011.
- The physical performance predictions are tested with a new dataset consisting of 90 new RT with associated physical tasks performed in the same 8:00AM-12:00AM time frame from December 13th 2011 to May 1st 2012.

Prediction formula's rational

- When the RT score is low, the linear tendency between RT and physical performance would not be the same as when the RT score is high.
- Therefore, the regression's lines would not be the same depending of the RT score value.
- Moreover, physical performance improves with time, so the equation should consider this time factor. However this improvement is obviously non linear.
- Taking this into consideration, the equation should consider this time factor plus the different tendencies relative to the RT score level.
- The equation must be trained with this time factor as well as with the RT factor. The connection weights are calculated taking into account the physical performance score error.
- The Prediction formula's rational is tested to evaluate if it can lead to a possible generalization on another dataset that has not been used to train the prediction equation.

Results



Results

- The mean absolute error on ICOTT predictions is 5.33 on a range of 39 (129-168)
- The mean absolute error on push-ups predictions is 4.87 on a range of 29 (56-86).
- The mean absolute error on sit-ups predictions is 1.65 on a range of 12 (24-36).

Conclusion and Discussion

- RT over 3 minutes appears to be a good predictor of physical performance.
- The non-linear equation allowed generalization of the Prediction formula on a new dataset of RT and allowed some accurate predictions of physical performance.
- Since sleep quantity and quality has been correlated with reaction times on the PVT, we believe that sleep might be one of the most important factors influencing reaction time results and proportionately physical performances in this study.
- These results support the importance of good sleep habits for increased physical performance. Using a simple RT tool could help people estimate their physical state related to their sleep schedule.

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