



**PERCEIVED EXERTION RELATIONSHIPS  
IN ADULTS AND CHILDREN**

Submitted by Danielle Lambrick to the University of Exeter as a thesis for the degree of  
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*Danielle Lambrick*

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## Abstract

The ratings of perceived exertion are commonly employed within both a clinical and exercise setting to quantify, monitor and evaluate an individual's exercise tolerance and level of exertion. Recent advances in the area of perceived exertion have led to novel applications in the use of the ratings of perceived exertion scale as a means of predicting an individual's maximal functional capacity ( $\dot{V}O_{2\max}$ ) for exercise (Eston, Lamb, Parfitt, & King, 2005; Eston, Faulkner, Mason, & Parfitt, 2006; Eston, Lambrick, Sheppard, & Parfitt, 2008; Faulkner, Parfitt, & Eston, 2007). Yet the utility of such procedures with low-fit individuals or children has received little or no research attention. As such, one aim of this thesis was to assess the efficacy of the ratings of perceived exertion in predicting the  $\dot{V}O_{2\max}$  of low-fit men and women, and healthy children. It is often presumed that like adults, a child's perception of exertion rises linearly with increases in exercise intensity, despite a limited amount research suggesting otherwise. Moreover, there is a lack of empirical evidence to suggest that children regulate their power output during a closed-loop exercise task in order to complete a given distance in the fastest time possible. Therefore, a further aim of this thesis was to explore the nature of the perceptual responses of young children across differing modes of exercise, and to examine whether children employ pacing strategies during running. In relation to this latter aim, it was of particular interest to explore pacing in relation to the ratings of perceived exertion during running, as the ratings of perceived exertion have been proposed as a key component of such a regulatory system during exercise (Tucker, 2009).

This thesis comprises a qualitative review of relevant literature, and six study chapters which were borne out of five empirical studies. The findings of studies 1 and 2 (chapters 3 & 4, respectively) support the utility of the ratings of perceived exertion to estimate  $\dot{V}O_{2\max}$  in low-fit men and women, during cycle ergometry exercise.

Importantly, this has been shown from a single exercise test at a low-moderate exercise intensity, during either a step-incremental (study 1) or ramp-incremental (study 2) protocol. Studies 3 and 4 (chapters 5 & 6, respectively) provide evidence to suggest that a child's perception of exertion may rise linearly or curvilinearly in relation to increasing work, during either cycle ergometry or treadmill exercise. These studies support the utility of a unique, curvilinear, paediatric ratings of perceived exertion scale in obtaining accurate exertional responses from young children, across differing modes of exercise. In contrast to studies 1 and 2, study 5 (chapter 7) suggests that the novel means of predicting maximal functional capacity from submaximal ratings of perceived exertion in adults is inaccurate with young children. This was particularly evident in the low intraclass correlation coefficients and wide limits of agreement obtained between measured- and predicted  $\dot{V}O_{2\max}$ , for both cycle ergometry and treadmill exercise. Study 6 (chapter 8) demonstrated that young children employ pacing strategies during an 800 m run, similar to adults, and that this improves with trial familiarisation. Moreover, the presence of other competitors has a detrimental effect on performance, particularly for girls.

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## Abbreviations

<b>ACSM</b>	American College of Sports Medicine
<b>ANOVA</b>	Analysis of Variance
<b>b·min<sup>-1</sup></b>	Beats per minute
<b>BABE</b>	Bug And Bag Effort scale
<b>BIA</b>	Bioelectrical Impedance Analysis
<b>CALER</b>	Cart And Load Effort Rating scale
<b>CERT</b>	Children's Effort Rating Table
<b>CR-10</b>	Category Ratio-10 scale
<b>DBP</b>	Diastolic Blood Pressure
<b>E-P scale</b>	Eston-Parfitt RPE scale
<b>GET</b>	Gaseous Exchange Threshold
<b>GXT</b>	Graded-exercise Test
<b>HR</b>	Heart Rate
<b>% HR<sub>max</sub></b>	Heart rate expressed as a percentage of maximal heart rate
<b>ICC</b>	Intraclass Correlation Coefficients
<b>L·min<sup>-1</sup></b>	Litres per minute
<b>LoA</b>	Limits of Agreement
<b>m</b>	Meters
<b>min</b>	Minutes
<b>ml·kg<sup>-1</sup>·min<sup>-1</sup></b>	Millilitres per kilogram per minute
<b>mmHg</b>	Millimeters of mercury

ABBREVIATIONS

<b>n</b>	Sample size
<b>OMNI</b>	Omnibus RPE scale
<b>PCERT</b>	Pictorial Children's Effort Rating Table
<b>r</b>	Pearson's correlation coefficient
<b>R</b>	Intraclass correlation coefficient
<b>R<sup>2</sup></b>	Coefficient of determination
<b>rev·min<sup>-1</sup></b>	Revolutions per minute
<b>RPE</b>	Ratings of Perceived Exertion
<b>RR</b>	Respiratory Rate
<b>s</b>	Seconds
<b>SBP</b>	Systolic Blood Pressure
<b>SD</b>	Standard Deviation
<b><math>\dot{V} \text{CO}_2</math></b>	Volume of Carbon Dioxide
<b><math>\dot{V}_E</math></b>	Ventilation
<b><math>\dot{V} \text{O}_2</math></b>	Volume of Oxygen Uptake
<b><math>\dot{V} \text{O}_2\text{max}</math></b>	Maximal Oxygen Uptake
<b><math>\dot{V} \text{O}_2\text{peak}</math></b>	Peak Oxygen Uptake
<b>% <math>\dot{V} \text{O}_2\text{max}</math></b>	Oxygen uptake expressed as a percentage of maximal oxygen uptake
<b>VT</b>	Ventilatory Threshold
<b>W</b>	Watts
<b>WR</b>	Work Rate