

# OPPITUNTEJA AKTIIVISTEN LIIKKUJIEN ITSE KERÄÄMÄN DATAN HYÖDYNTÄMISESTÄ

Jussi Peltonen, PhD  
Senior Researcher

Polar Electro

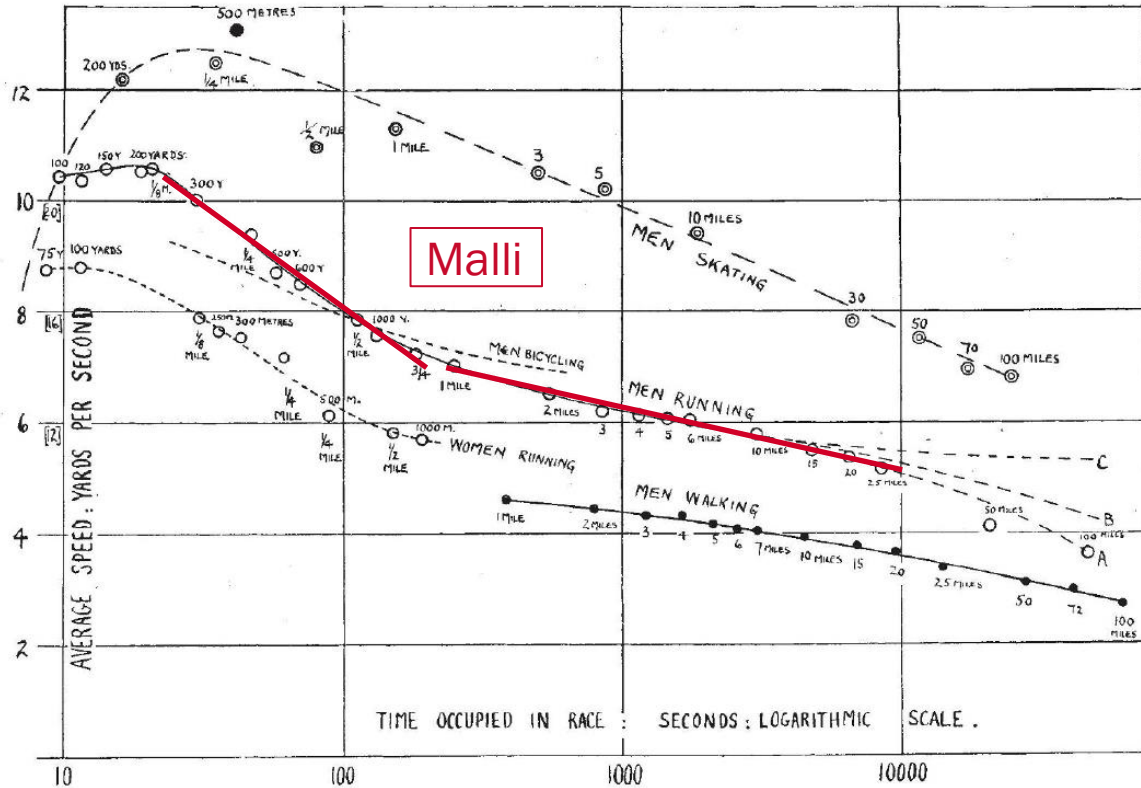
2.12.2021



**POLAR**

The Physiological Basis of Athletic Records.<sup>1</sup>


By Prof. A. V. HILL, F.R.S.





## RESEARCH ARTICLE

# A minimal power model for human running performance

**Matthew Mulligan<sup>1</sup>, Guillaume Adam<sup>2</sup>, Thorsten Emig<sup>2,3\*</sup>** 

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# JUOKSUN MALLINTAMINEN

$$T(d) = \begin{cases} -\frac{d}{\gamma_l v_m} \frac{1}{W_{-1} \left[ -\frac{d}{d_c \gamma_l} e^{-1/\gamma_l} \right]} & \text{for } d \geq d_c \\ -\frac{d}{\gamma_s v_m} \frac{1}{W_{-1} \left[ -\frac{d}{d_c \gamma_s} e^{-1/\gamma_s} \right]} & \text{for } d \leq d_c \end{cases},$$

# JUOKSUN MALLINTAMINEN

Maksimaalinen aerobinen  
teho ( $\text{VO2}_{\text{max}}$ )

Juoksun taloudellisuus

$$T(d) = \begin{cases} -\frac{d}{\gamma_l v_m} \frac{1}{W_{-1} \left[ -\frac{d}{d_c \gamma_l} e^{-1/\gamma_l} \right]} & \text{for } d \geq d_c \\ -\frac{d}{\gamma_s v_m} \frac{1}{W_{-1} \left[ -\frac{d}{d_c \gamma_s} e^{-1/\gamma_s} \right]} & \text{for } d \leq d_c \end{cases},$$

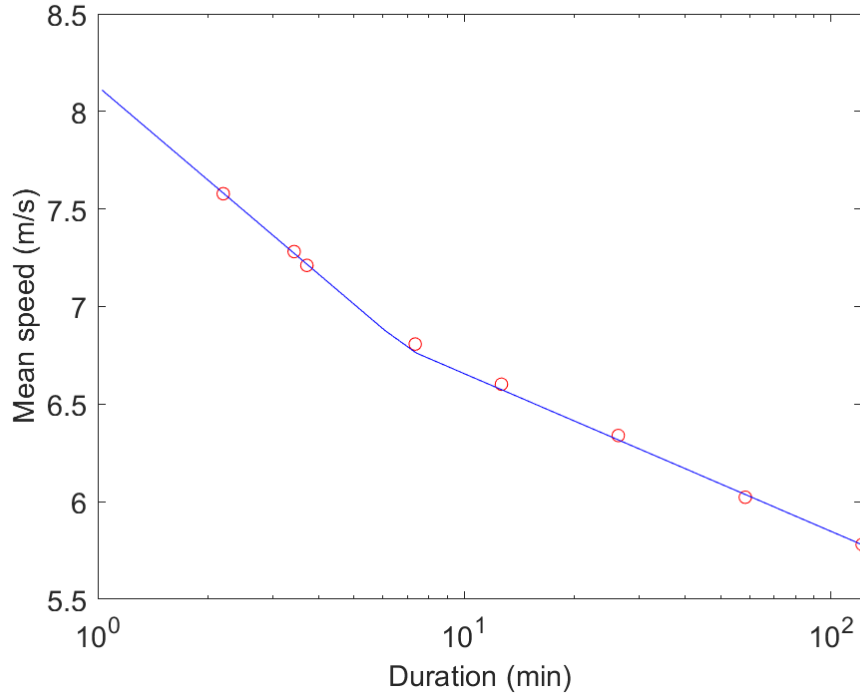
1)  $v_m$  = “maksimaalinen aerobinen nopeus”

2)  $t_c$  = “aika uupumukseen” nopeudella  $v_m$

3)  $E_l$  = kestävyysindeksi (submax. nopeus)

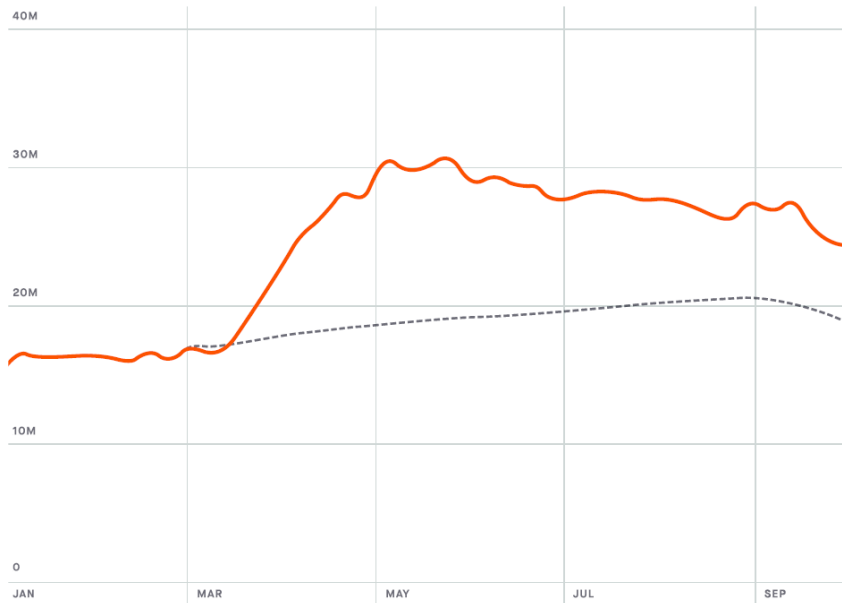
4)  $E_s$  = kestävyysindeksi (supramax. nopeus)

# VALIDAATIO



## Juoksun maailmanennätykset

Record	WR men		
$t_c$ [min]		6.26	
$v_m$ [m/min]		411.72	
100 $\gamma_s$		9.99	
100 $\gamma_l$		5.36	
$E_s$		0.37	
$E_l$		6.46	
distance	$T$	$T_{model}$	%
1000	02:11.96	02:11.94	-0.02
1500	03:26.00	03:26.24	+0.12
1609.34	03:43.13	03:42.91	-0.10
3000	07:20.67	07:20.99	+0.07
5000	12:37.35	12:37.10	-0.03
10000	26:17.53	26:18.84	+0.08
21097.5	58:23.00	58:11.94	-0.32
42195	2:01:39.00	2:01:52.99	+0.19
mean			0.12



# Strava Stats

20 YEAR IN  
20 SPORT

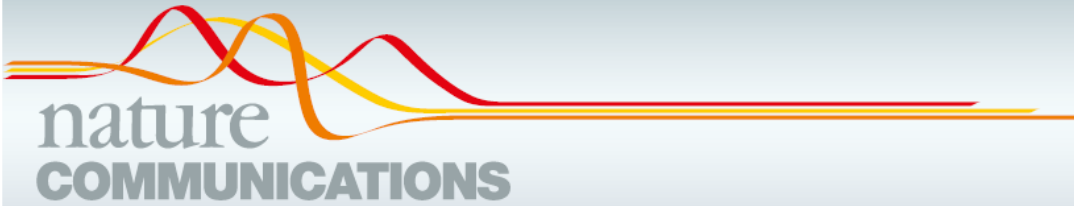
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Total Athletes 73.0 million

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Activities This Year 1.1 billion

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ARTICLE

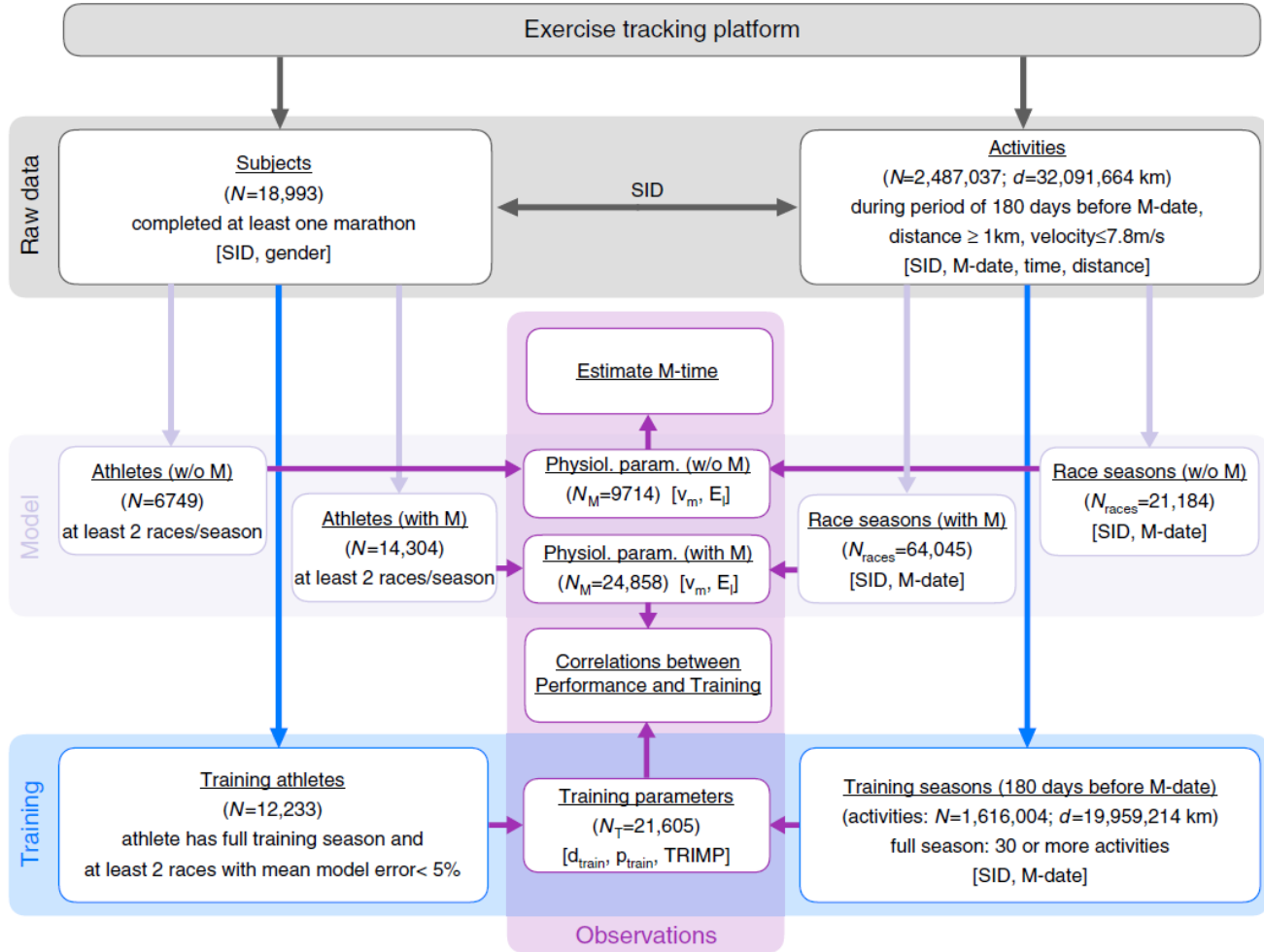
<https://doi.org/10.1038/s41467-020-18737-6>

OPEN

# Human running performance from real-world big data

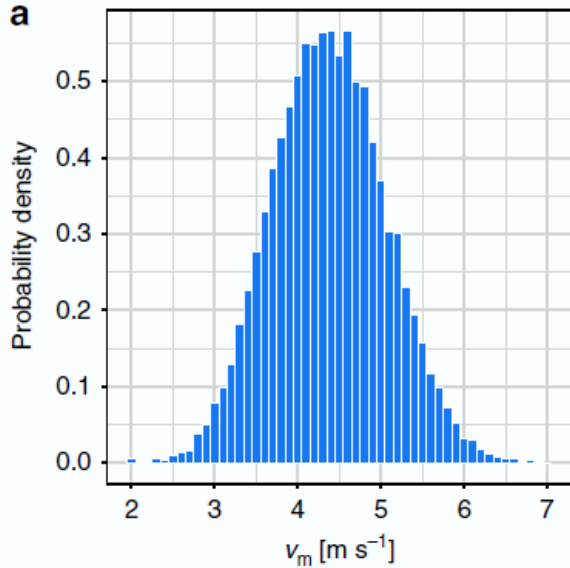
Thorsten Emig <sup>1</sup>✉ & Jussi Peltonen <sup>2</sup>



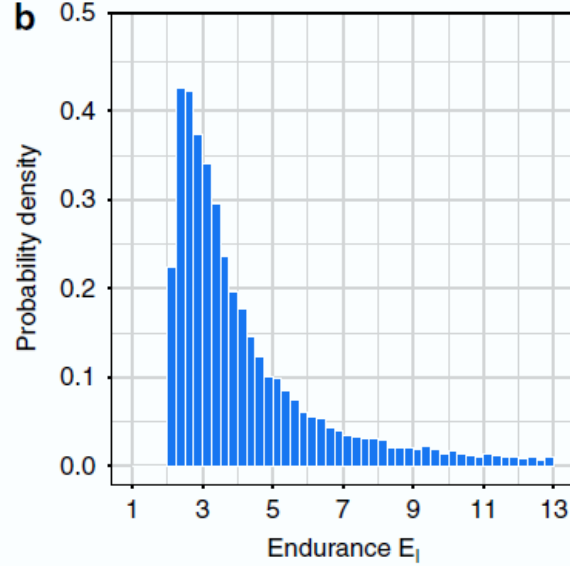


# JAKAUMAT

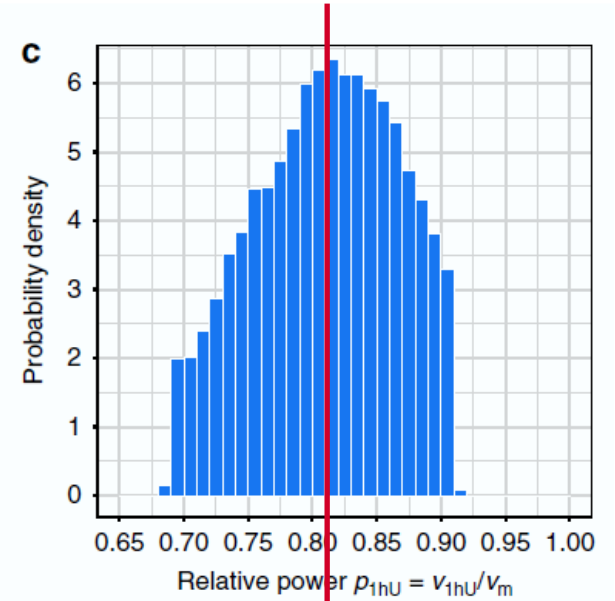
Nopeus,  $v_m$



Kestävyys,  $E$



“Laktaattikynnys”

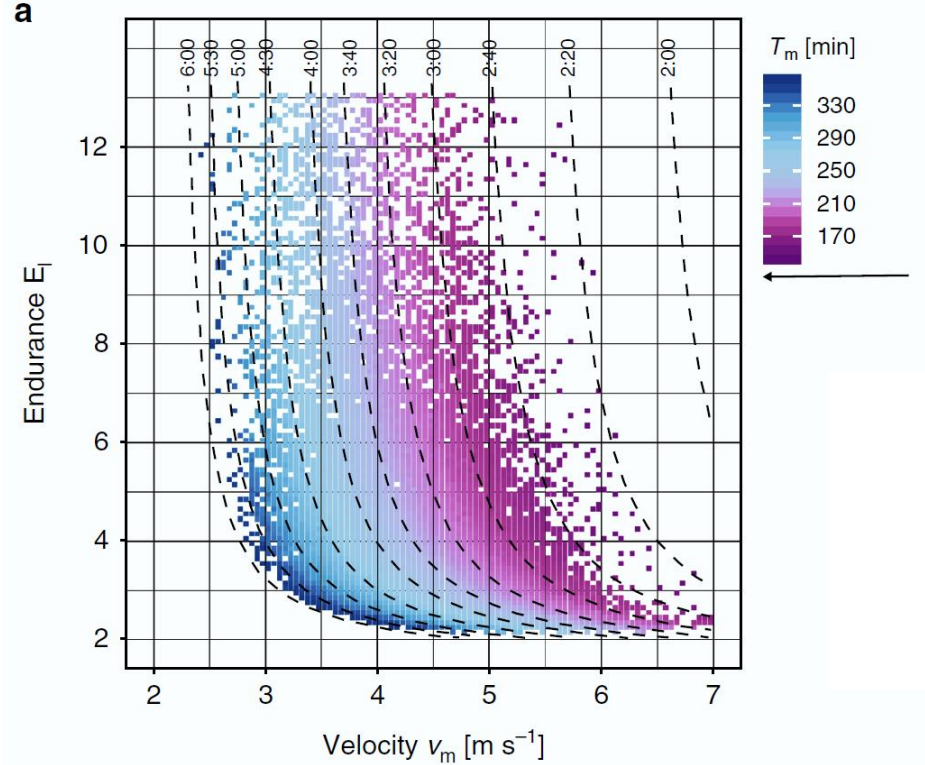


82%

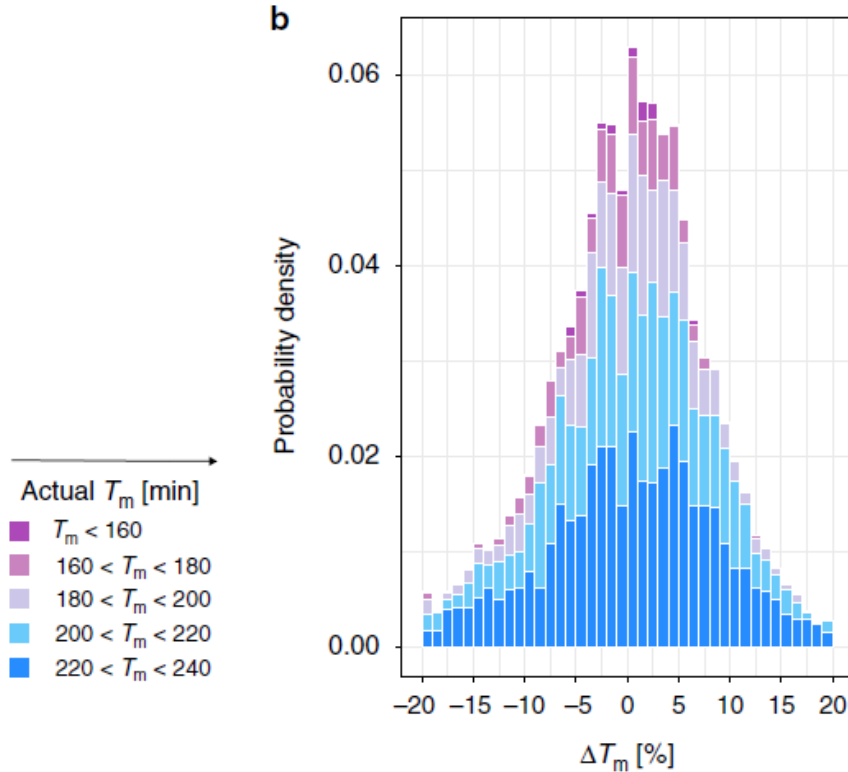
# ENNUSTEET

Eri parametrit => sama aika

$v_m$	E	Aika
5,0	3	3:26:19
4,0	12	3:24:41

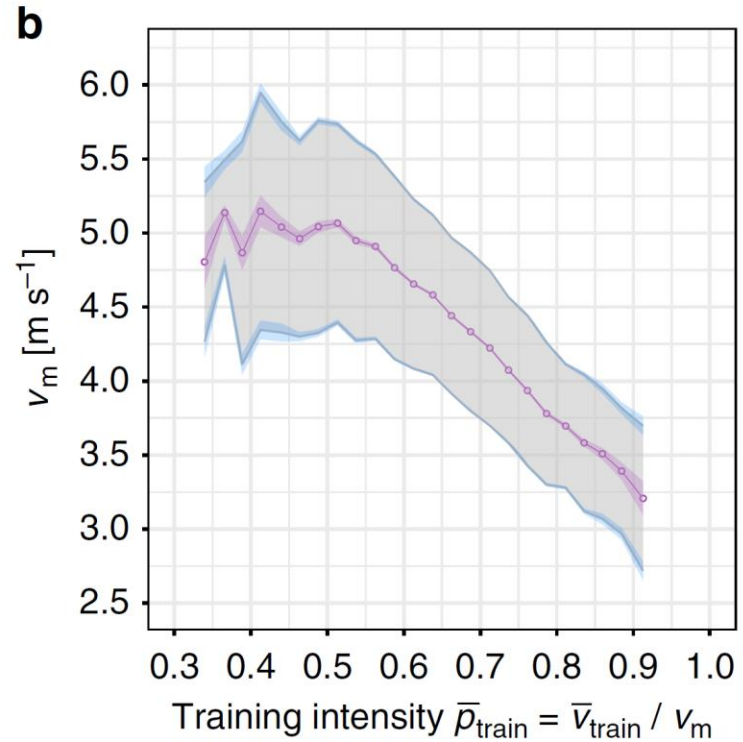
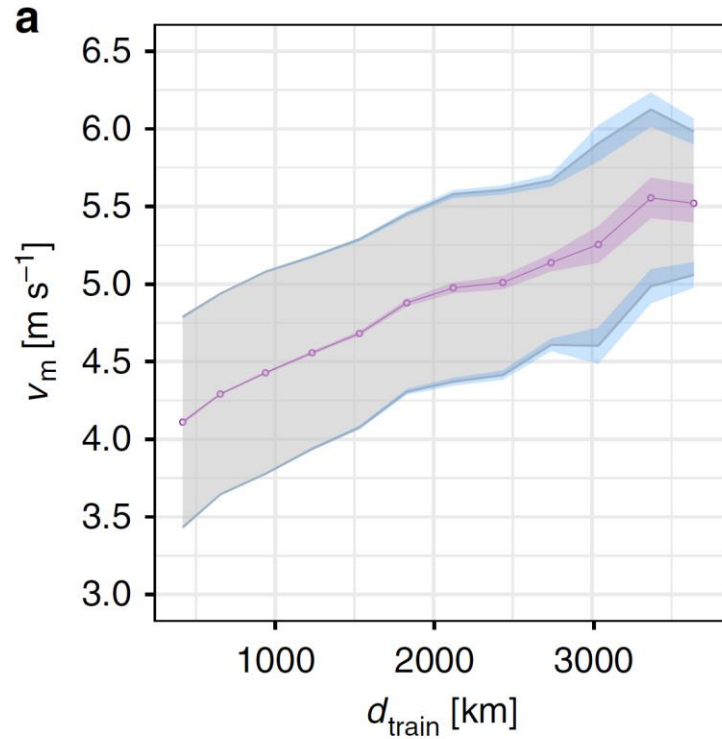


# ENNUSTEET

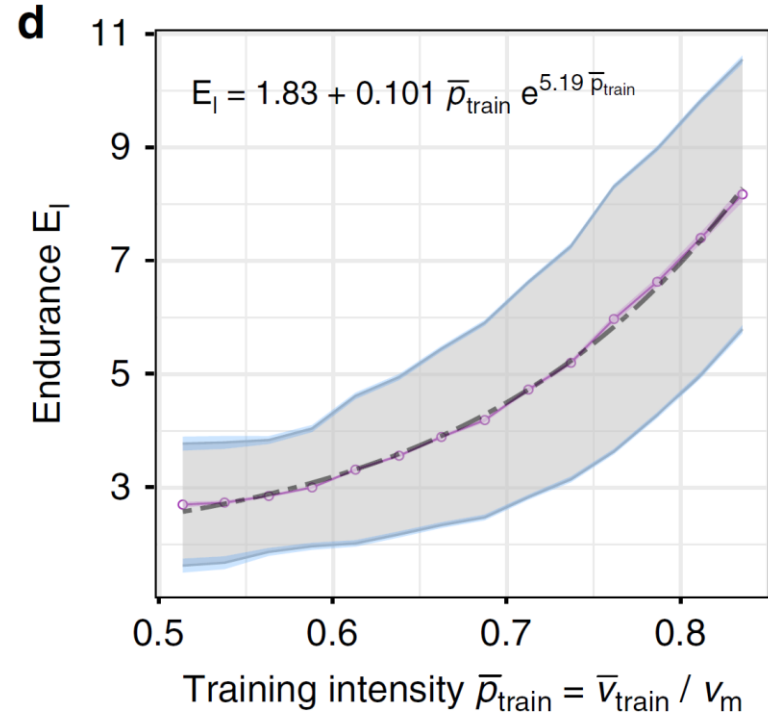
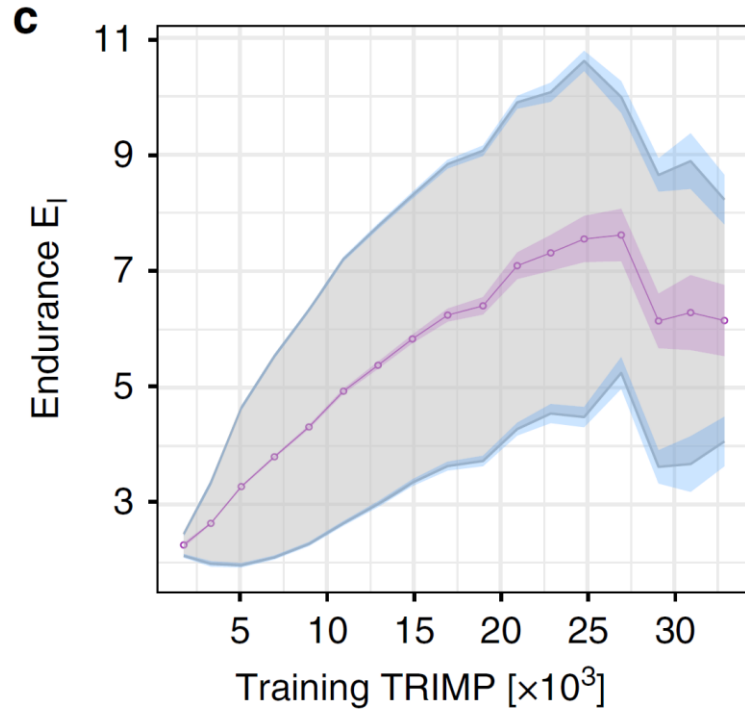


- Nopeimmat juoksijat ennustettavimpia
- Ennusteen hajonta  $\pm 10\%$
- Keskimääräinen virhe 2%

# KORRELAATIOT



# KORRELAATIOT



# YHTEENVETO

## Vahvuudet

- Testaaminen laboratorion ulkopuolella
- Tarkkuus
- Ei ennakkotietoja (ikä, pituus, paino jne)

## Heikkoudet

- Kontrollin vähyys
- Ei tutkittua yhteyttä laboratoriotestiin
- Harjoittelusta vain korrelaatiot

# TULEVAISUUS

- Sykkeen tai tehon käyttö
- Vertailu mattotestiin
- Syy-seuraus-suhteen osoittaminen



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