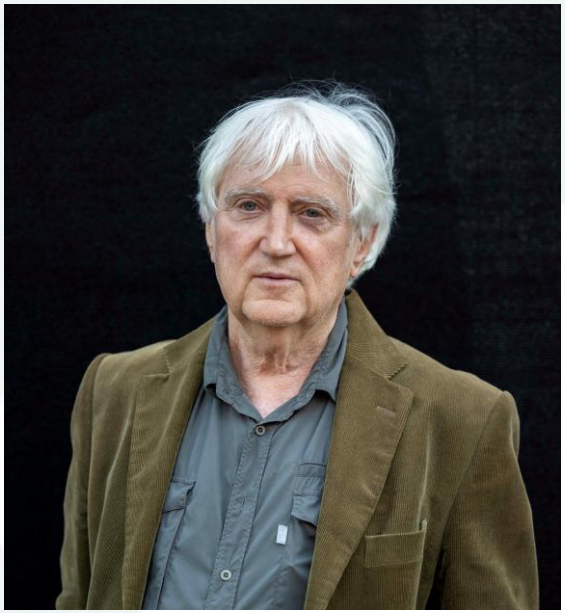
Najważniejsza funkcja na świecie

Andrzej Dąbrowski
Wrocław

Leopold Kronecker
1823-1891

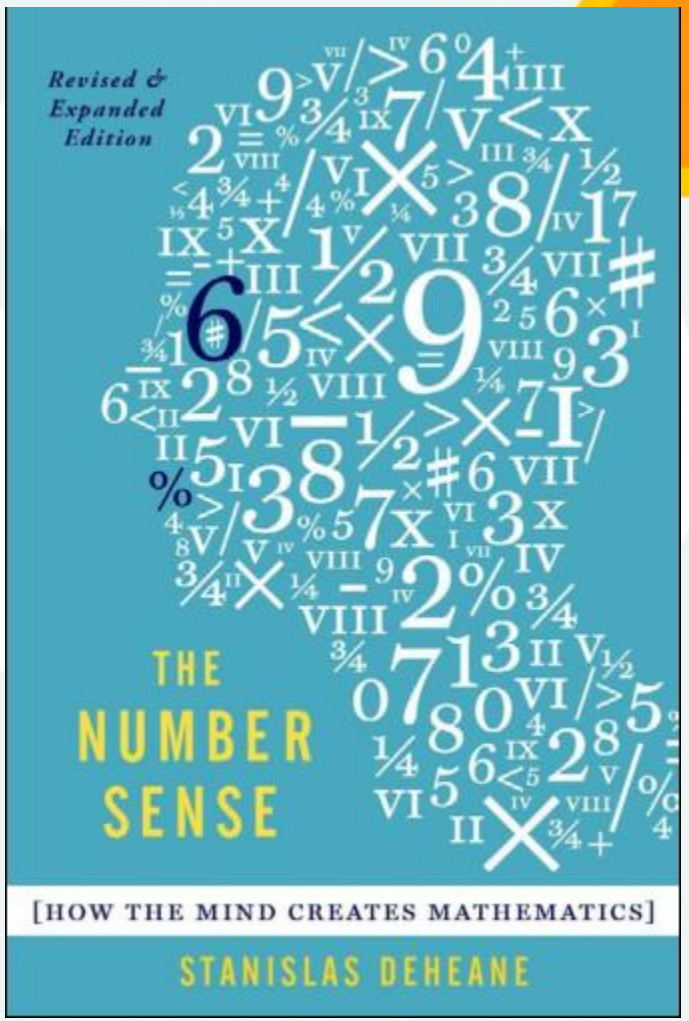
Funkcję ...stworzył dobry Bóg
człowiek zaś nauczył się sprawnie używać funkcji ...

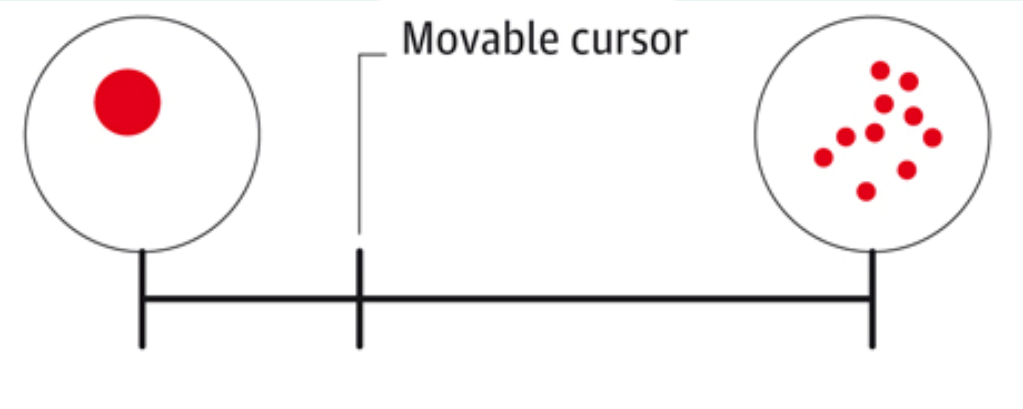
Indianie Munduruku
7000
Amazonia

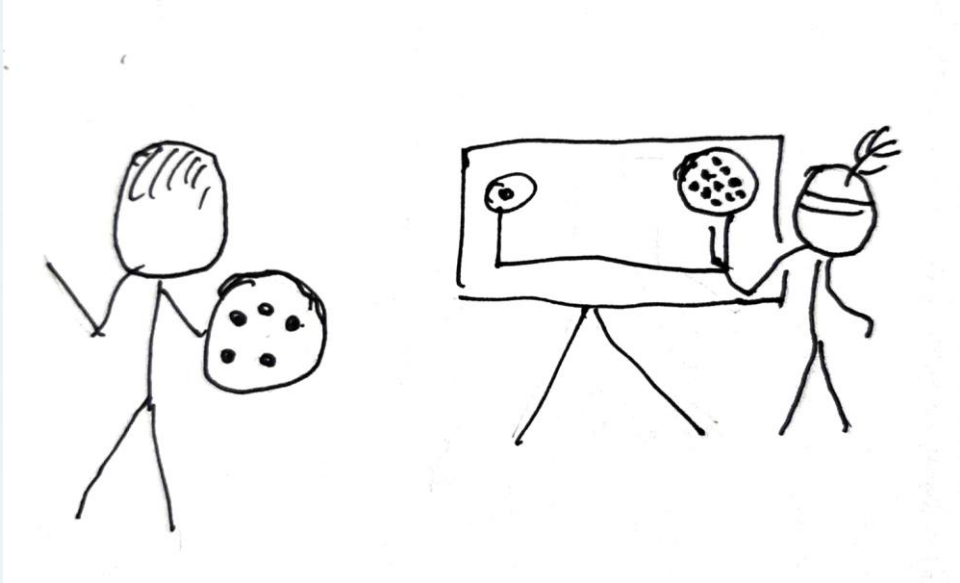


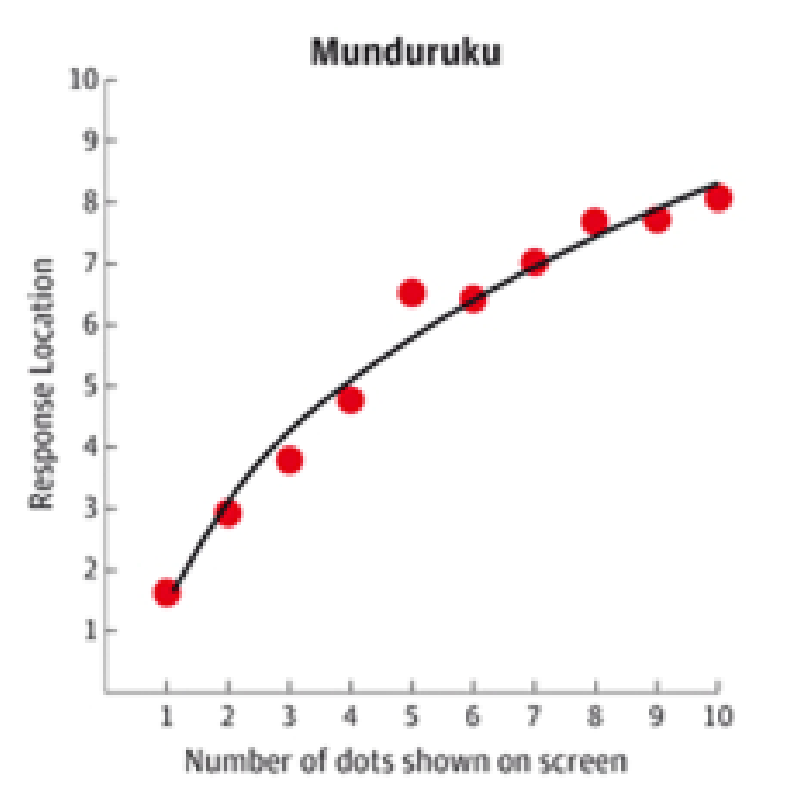
Pierre Pica
prof. CNRS
lingwistyka teoretyczna

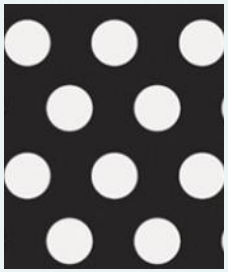
Stanislas Dehaene
Collège de France
Matematyka, neuronauka



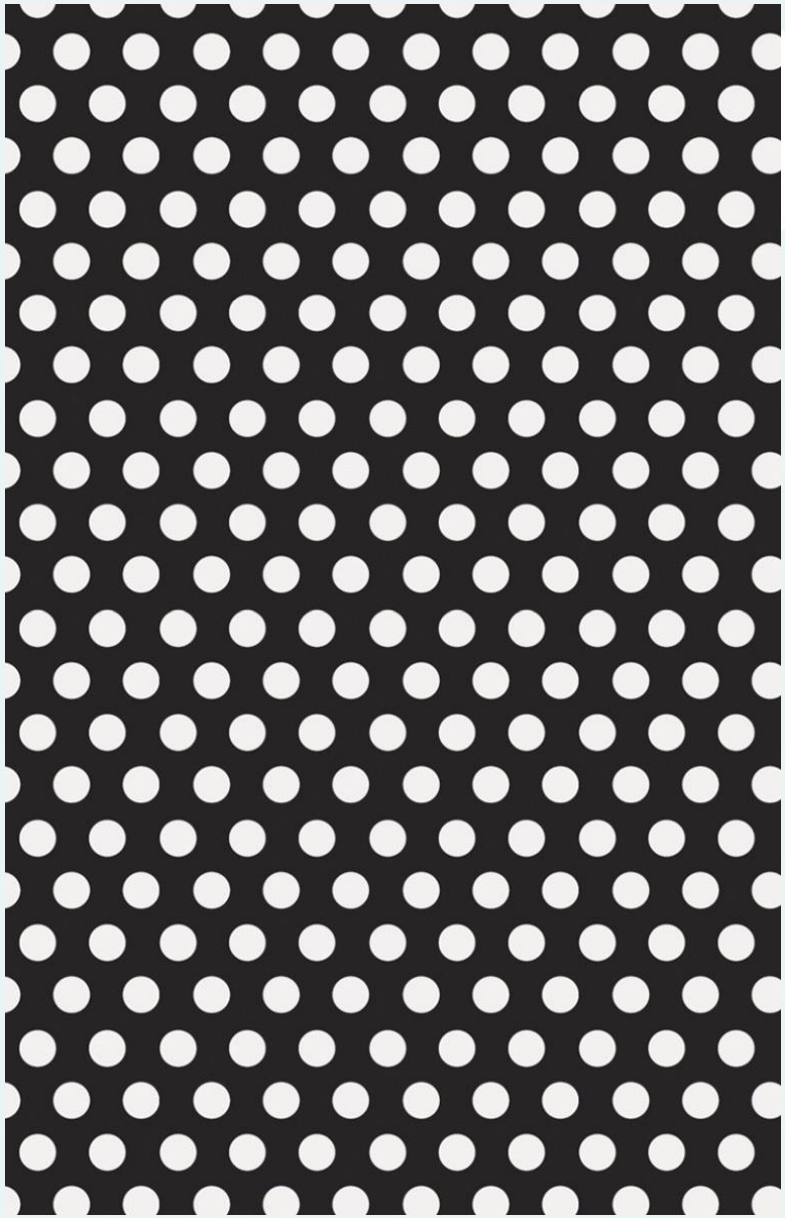

Movable cursor

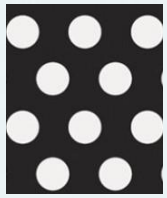


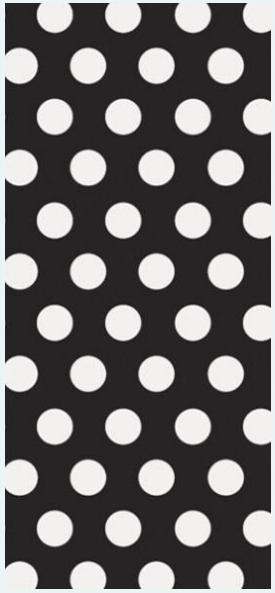

Munduruku
Response Location
Number of dots shown on screen
1
2
3
4
5
6
7
8
9
10

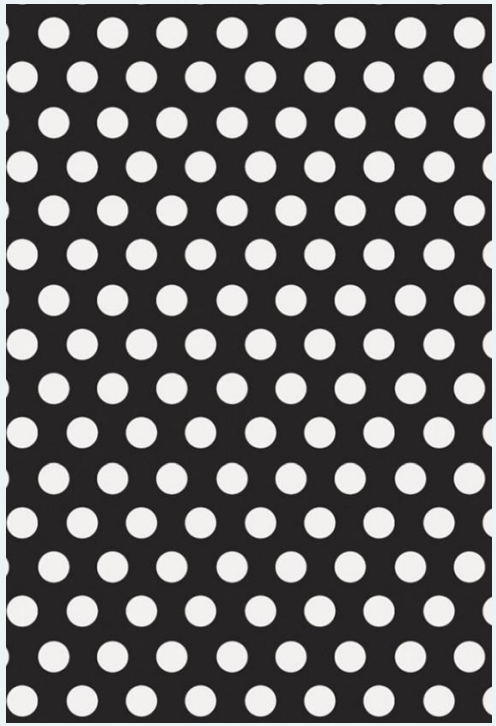


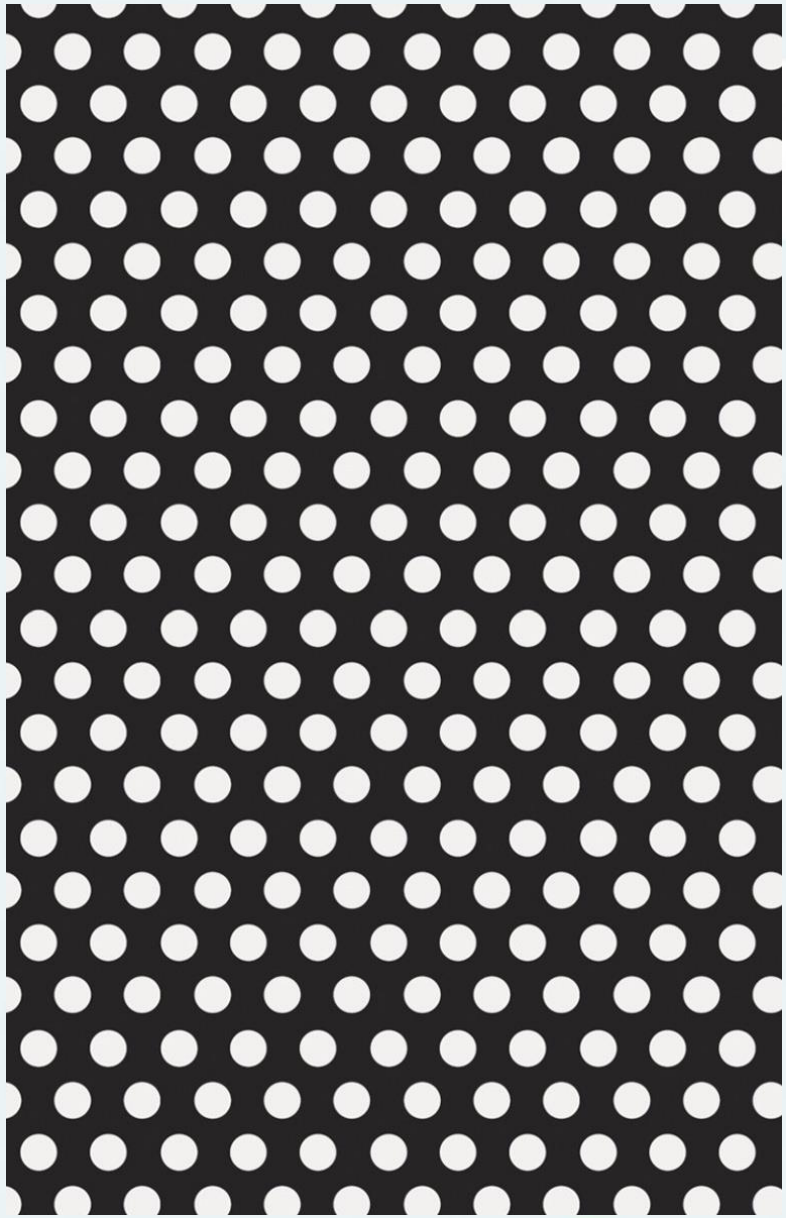
?

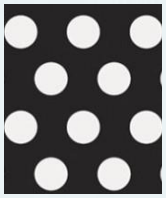


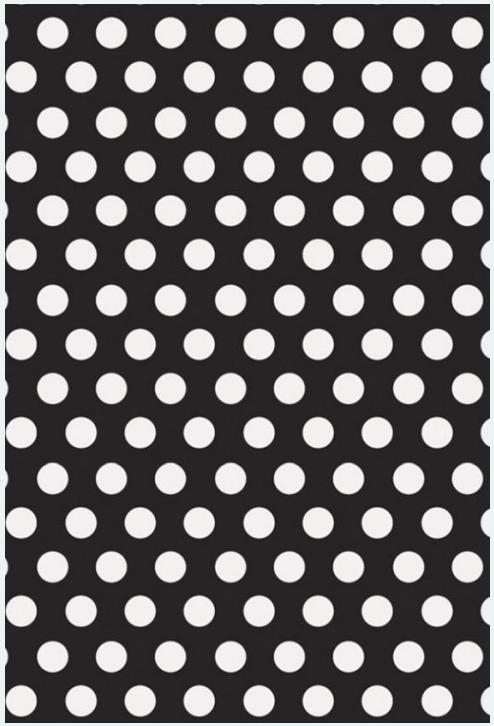


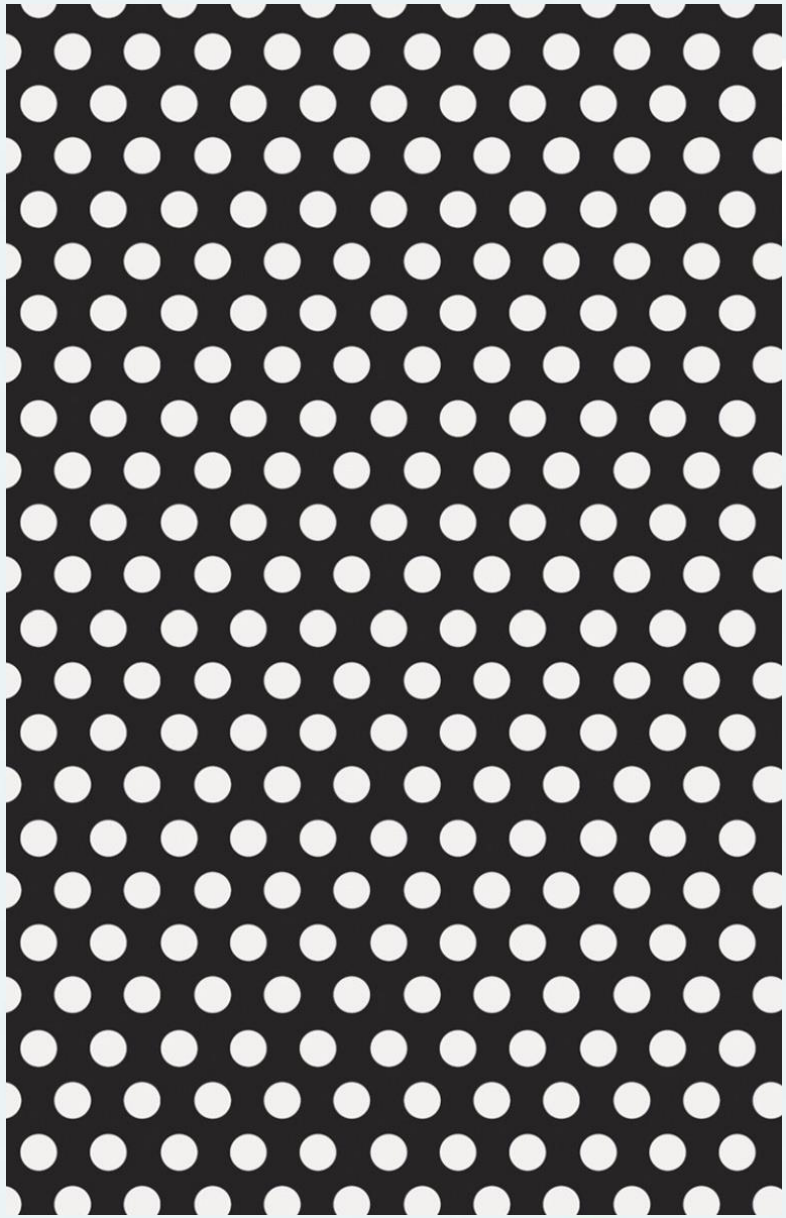


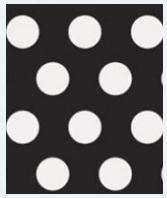


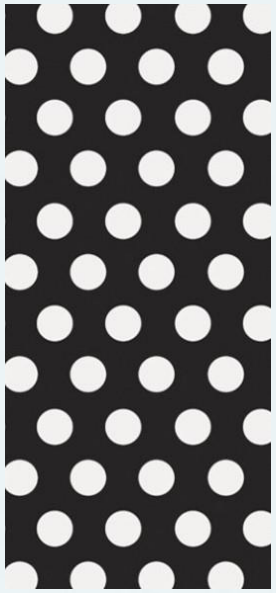


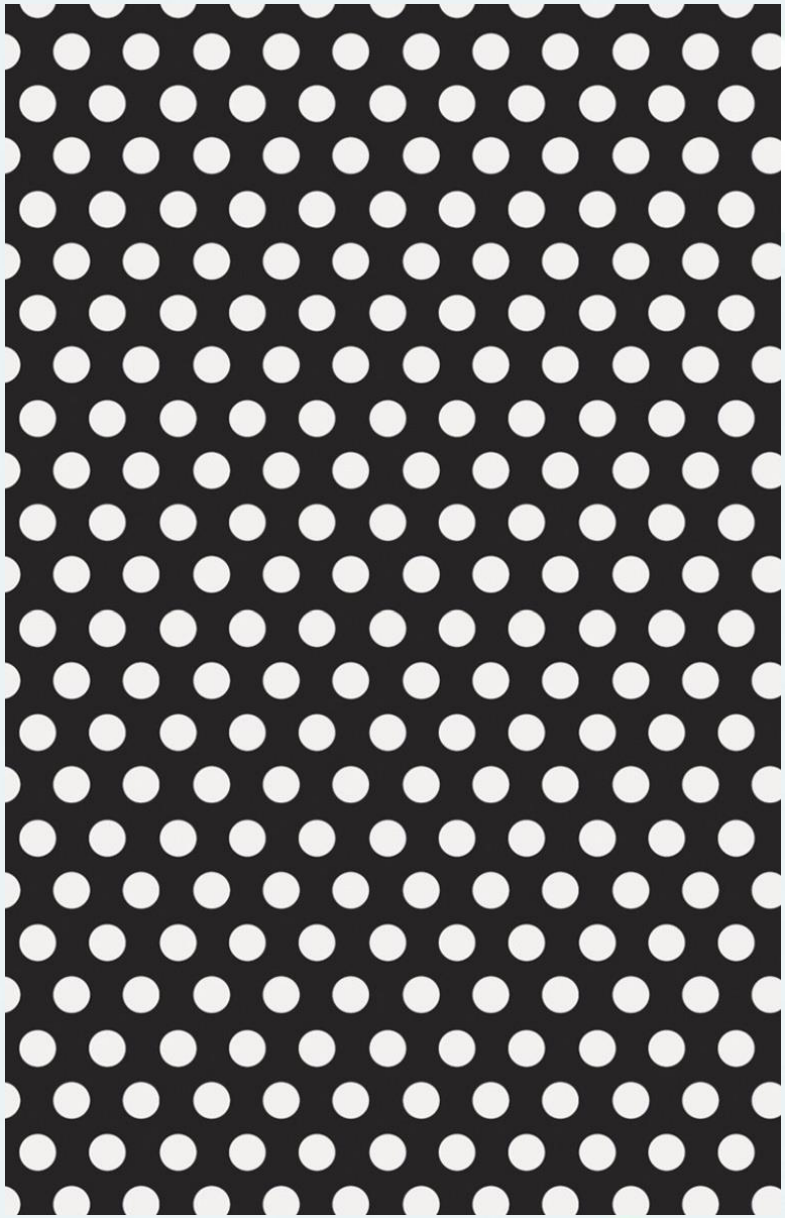








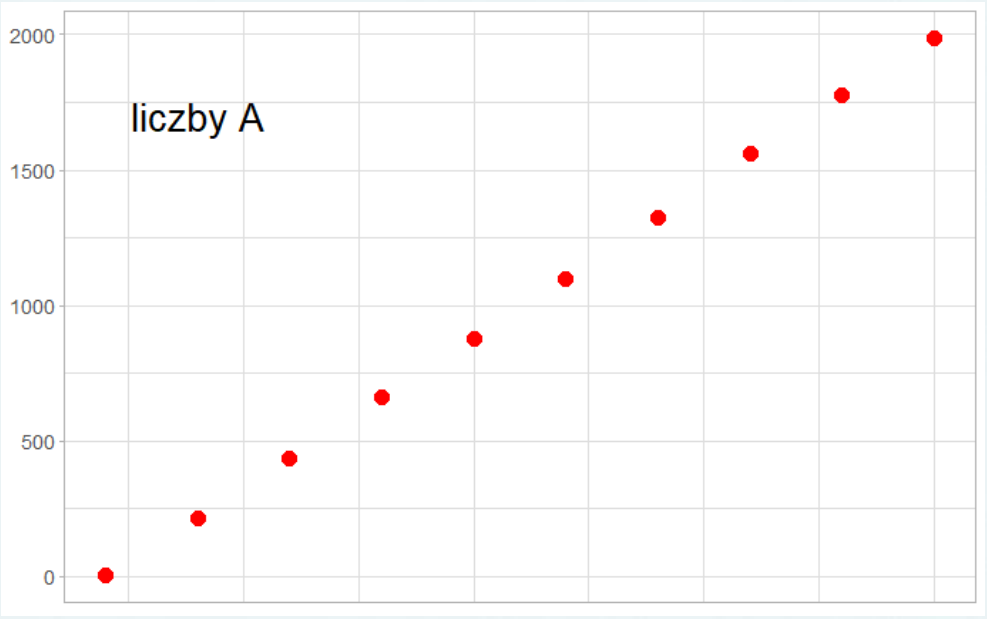


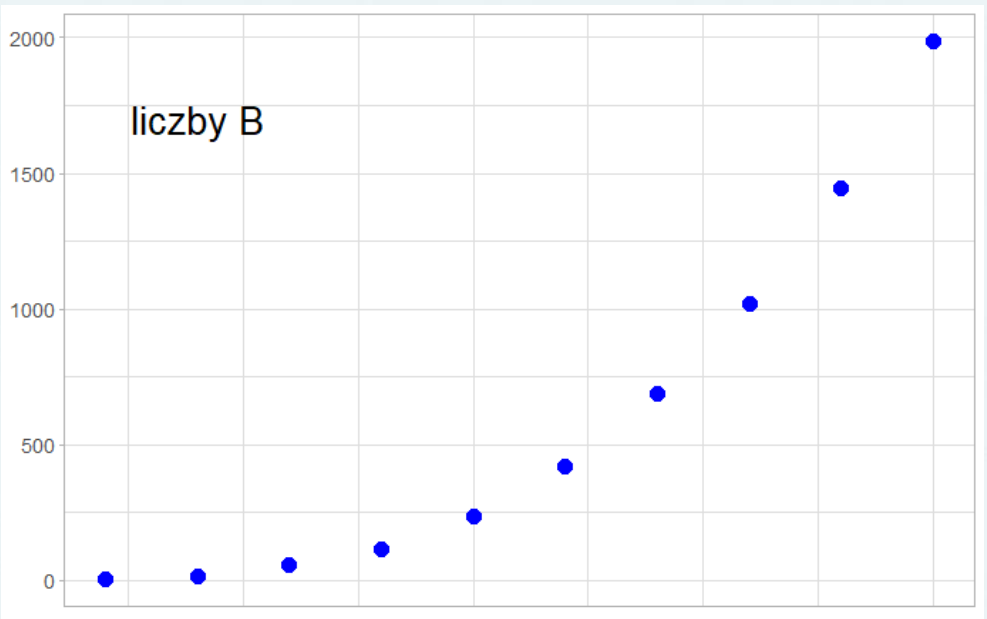


?

A	879	5	1322	1987	212	1776	1561	437	1098	663
B	238	5	689	1987	16	1446	1018	58	421	117

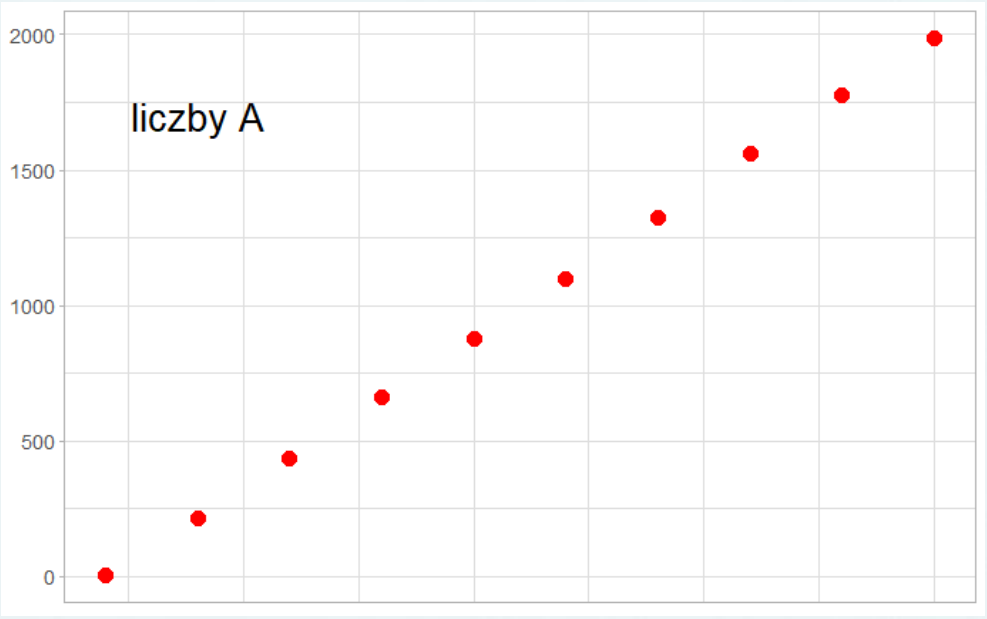
Które liczby: A czy B
są bardziej równomiernie rozmieszczone
między 0 i 2000?

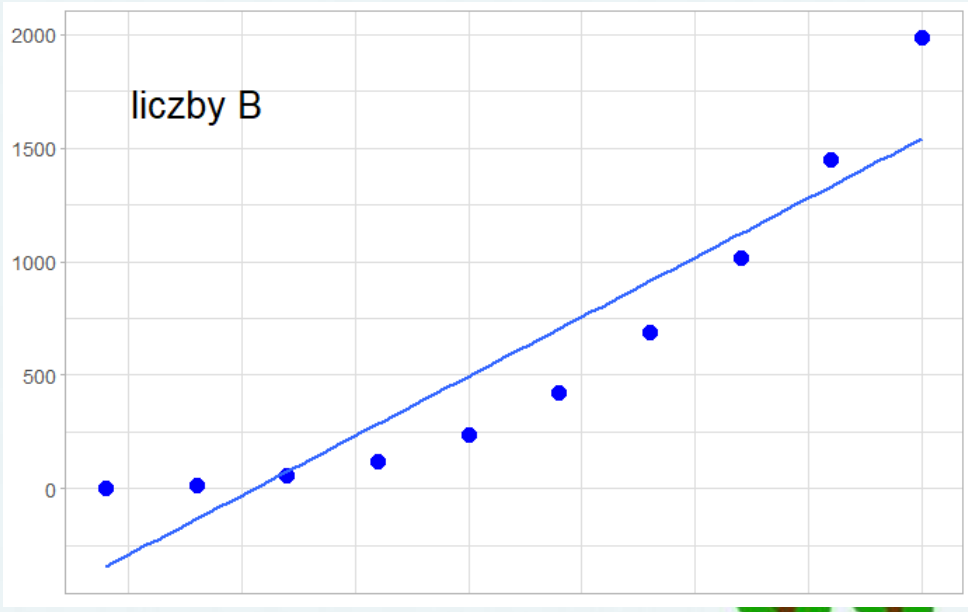




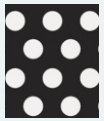
A	879	5	1322	1987	212	1776	1561	437	1098	663
B	238	5	689	1987	16	1446	1018	58	421	117

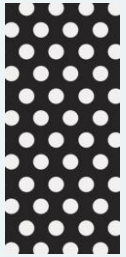
Które liczby: A czy B
są bardziej równomiernie rozmieszczone
między 0 i 2000?

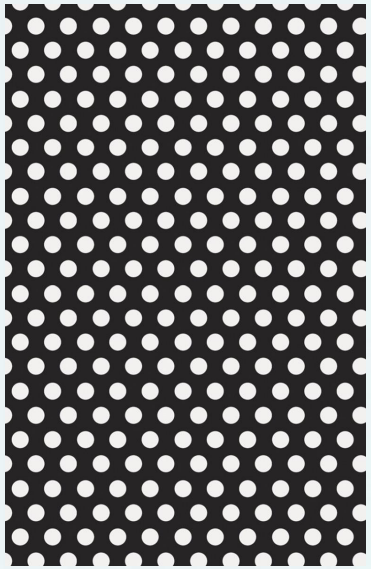




1 3 9



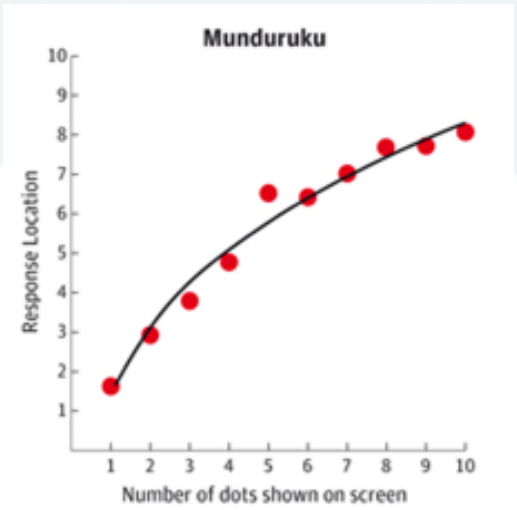


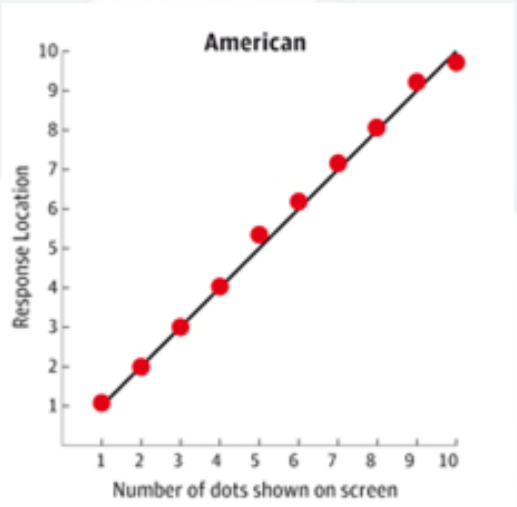


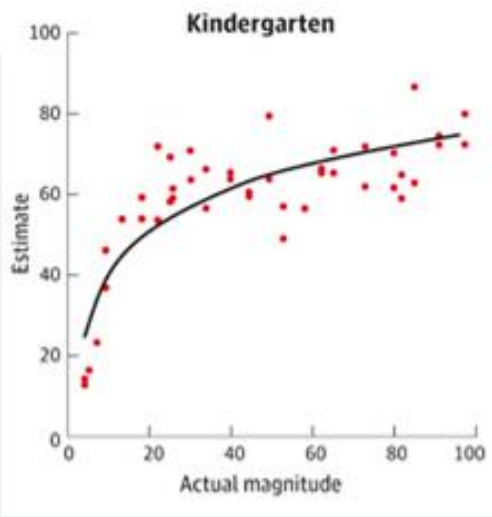
10 50 250

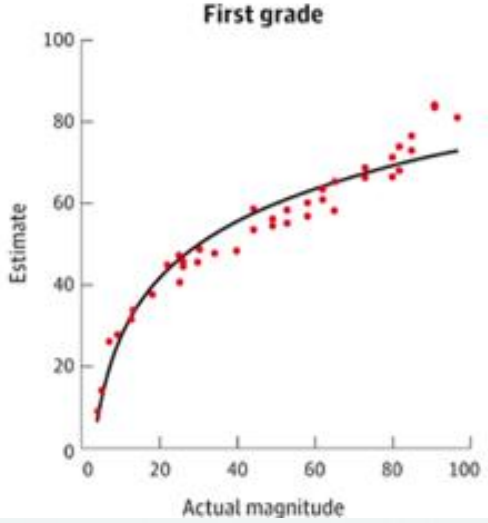
Proporcja !!

y/x=z/y log(y)-log(x) = log(z)-log(y)





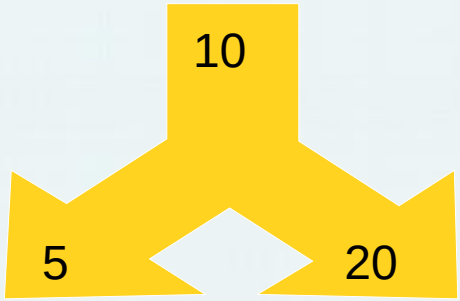




Funkcję logarytm stworzył dobry Bóg
człowiek zaś nauczył się sprawnie używać funkcji liniowej

1			**10**			**100**			**1000**
	2	5		20	50		200	500	

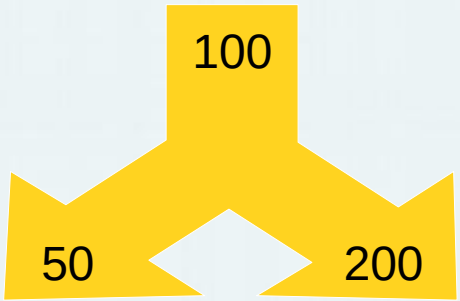
1795 Rewolucja Francuska – dziesiętny system metryczny.
Główne jednostki: 1,10,100,1000,…
Jednostki pośrednie są podzieleniem/pomnożeniem jednostki głównej przez 2



10*2=20

20*2.5=50

50*2=100



Płk. Charles Renard
1847 - 1905

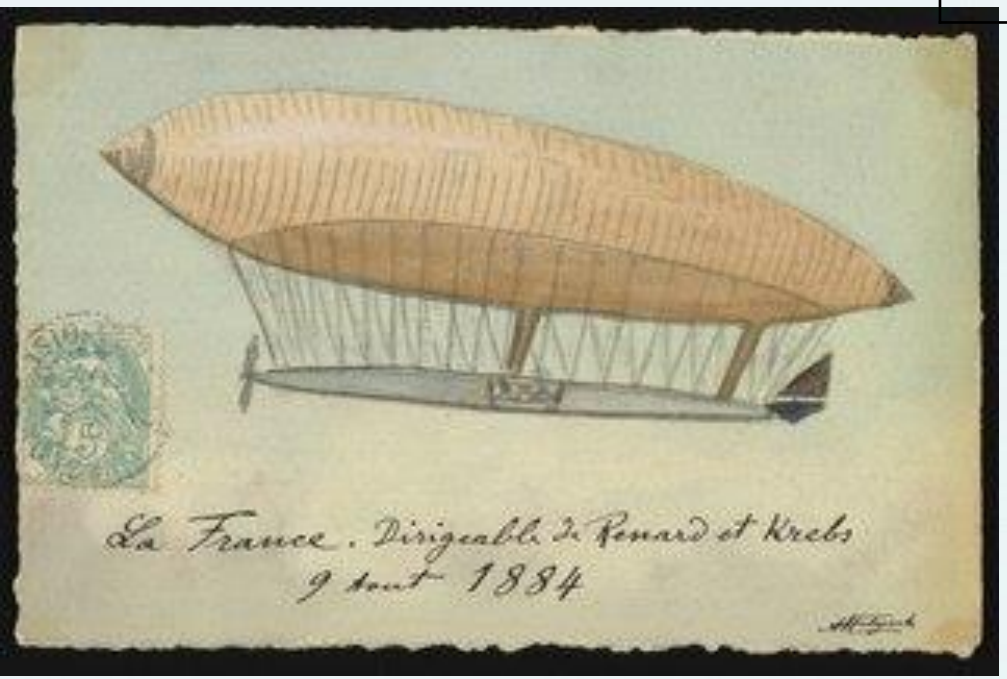
1877 Liczby Renarda (liczby normalne) → ISO
Minimalny błąd względny

System **Rn**:
1 – 10 na n proporcjonalnych odcinków

R5

0	1	2	3	4	5	6
1,00					10,00	
q^0	q^1	q^2	q^3	q^4	q^5	q^6

$q=10^{1/5} \approx 1{,}5850$



Redukcja rodzajów lin balonowych z 425 do 17

n	1	2	3	4	5	6	7	8	9	10	11
$10^{n/5}$	1,58	2,51	3,98	6,31	10,00	15,85	25,12	39,81	63,10	100,00	158,49
R5	1,6	2,5	4	6,3	10	16	25	40	63	100	160

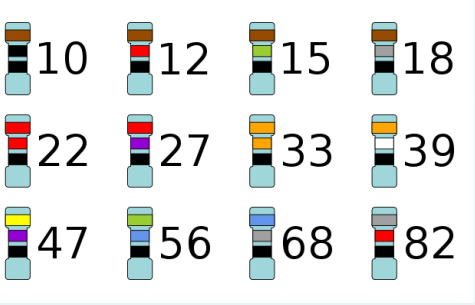
Śruby 5mm – 50 mm

R5	1,6	2,5	4	6,3	10	16	25	40	63	100	160

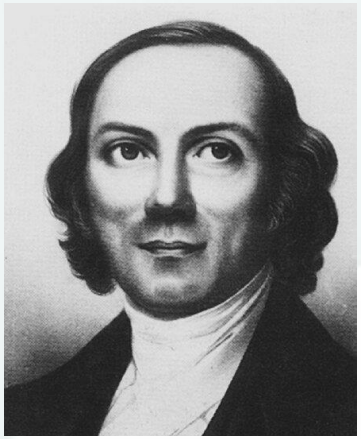
2		4		8		16		32
	2,828		5,657		11,314		22,627	

$q=\sqrt{2} \approx 1.4142$

$2*q=2,828=4/q \quad 4*q=5,657=8/q \quad 8*q=11,314=16/q$



R12 (E12) $q=10^{1/12} \approx 1,2115$



Ernst Heinrich Weber
(1795–1878)
fizjolog i anatom

$$\Delta p = c * \Delta s / s$$

$$p'(s) = c/s$$

$$p(s) = \log(s/s_0)$$

Gustav Theodor Fechner
(1801- 1887)
fizyk, filozof i psycholog

Prawo Webera-Fechnera

Elementy der Psychophysik (1860)

Prawo Webera - Fechnera na co dzień

$decybel = 20\log_{10}(p/p_{ref})$

p – średnie odchylenie ciśnienia atmosferycznego
p_{ref} - wartość progowa dla normalnie słyszącej osoby, odpowiadaj

Pokrętło głośności w radio działa logarytmicznie

10 dB – szelest liści przy łagodnym wietrze
20 dB – szept
60 dB – odkurzacz (100 * szept)
90 dB – ruch uliczny (3000 *szept)

300 dB – (szacowane, 100 m) wybuch wulkanu Krakatau w Indonezji w 1883 r. Prawdopodobn

Prawo Webera - Fechnera na co dzień

$decybel = 20\log_{10}(p/p_{ref})$

$PH = -\log_{10}([H^+])$

$[H^{+}]$ stężenie jonów wodorowych w molach na litr

Cytryna 2
Pomarańcza 4
Woda 7

Prawo Webera - Fechnera na co dzień

$decybel = 20\log_{10}(p/p_{ref})$

$PH = -\log_{10}([H^+])$

$M = \log_{10}(A/A_0)$

Skala Richtera
A – maksymalne odchylenie sejsmografu
A0 – parametr zależny od odległości od epicentrum

M>8 zdarzają się raz na rok
M=9.5 Wielkie trzęsienie w Chile 1960

Prawo Webera - Fechnera na co dzień

$decybel = 20\log_{10}(p/p_{ref})$

$PH = -\log_{10}([H^+])$

$M = \log_{10}(A/A_0)$

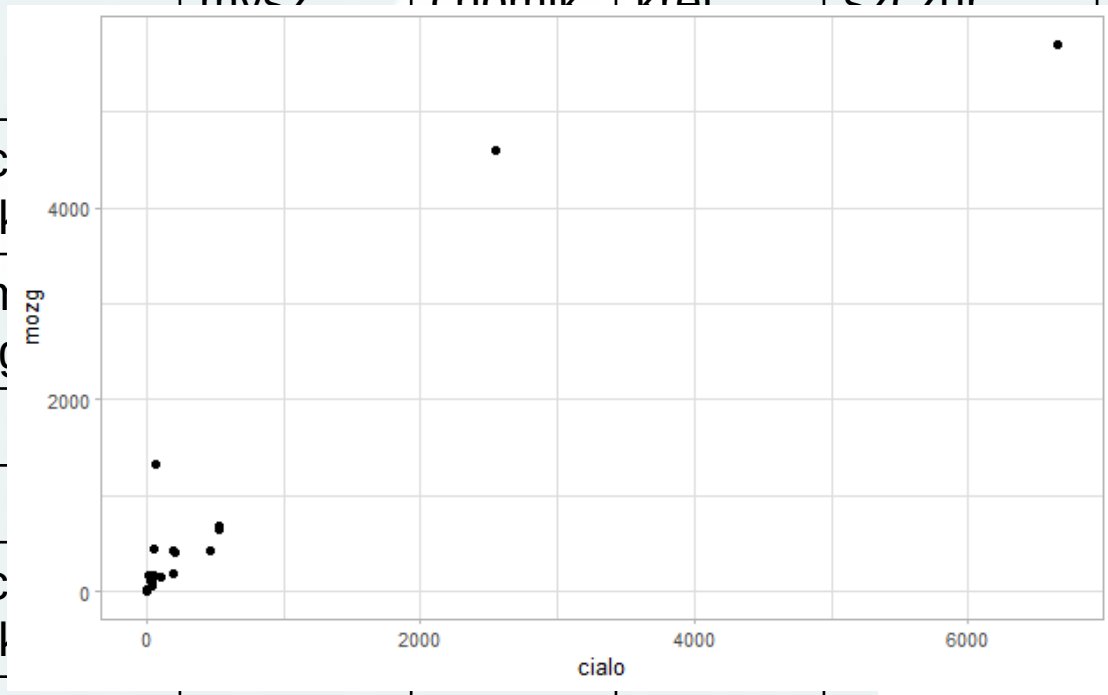
Obserwowana wielkość gwiazdowa

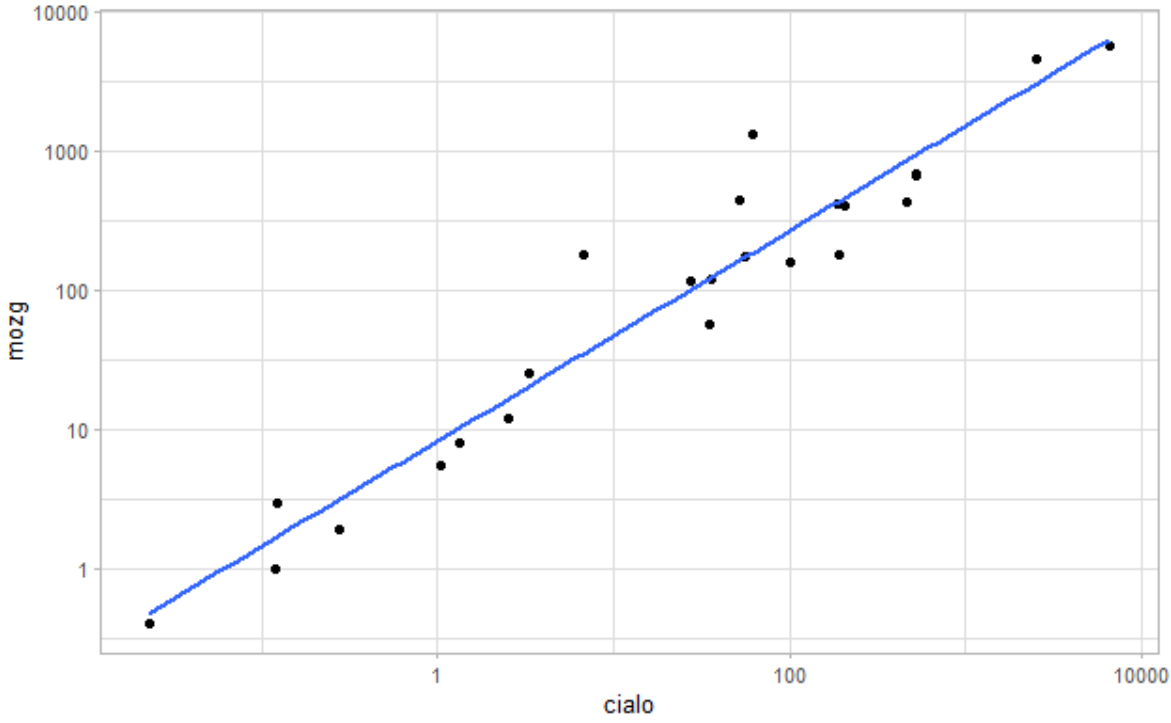
$m = -2{,}5\log_{10}(J/J_V)$

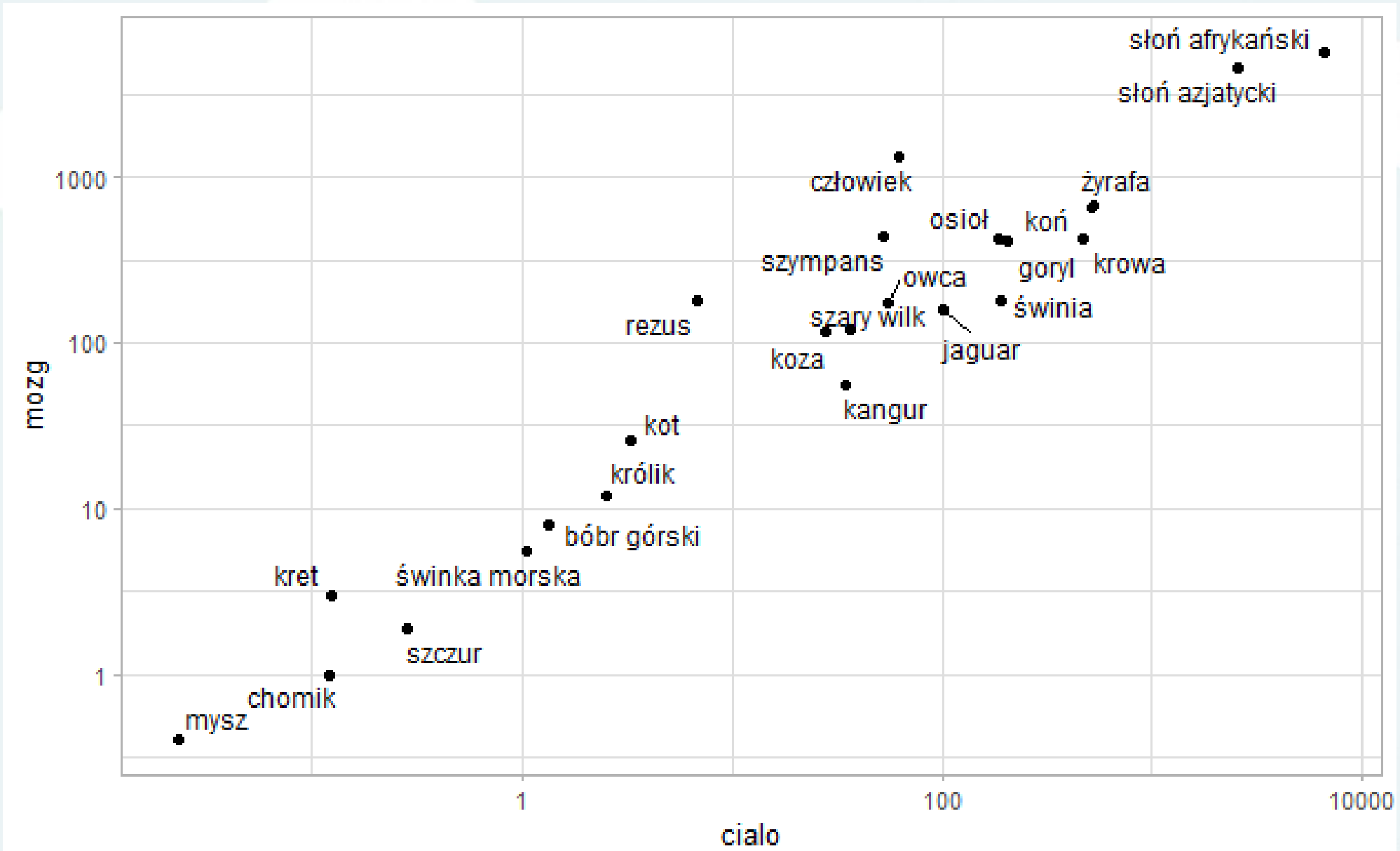
J jasność gwiazdy
J_V jasność Vegi

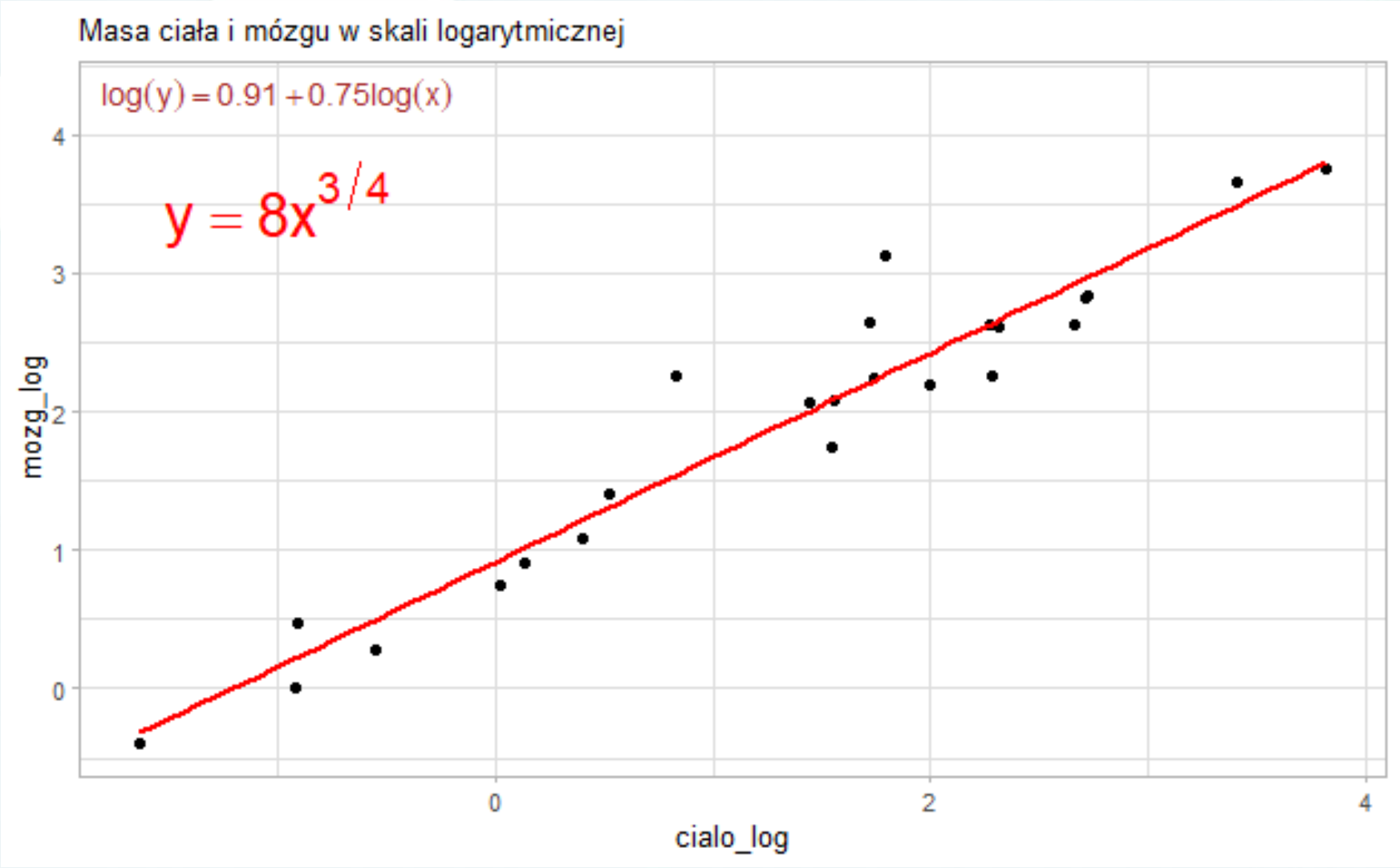
m=1, … ,6 wielkości gwiazdowe Klaudiusza Ptolemeusza (100-170)
m=-4,2 Wenus (48 razy jaśniejsza niż Vega)
m=-26,83 Słońce
m=31.05 najdalszy obiekt w teleskopie Hubbla

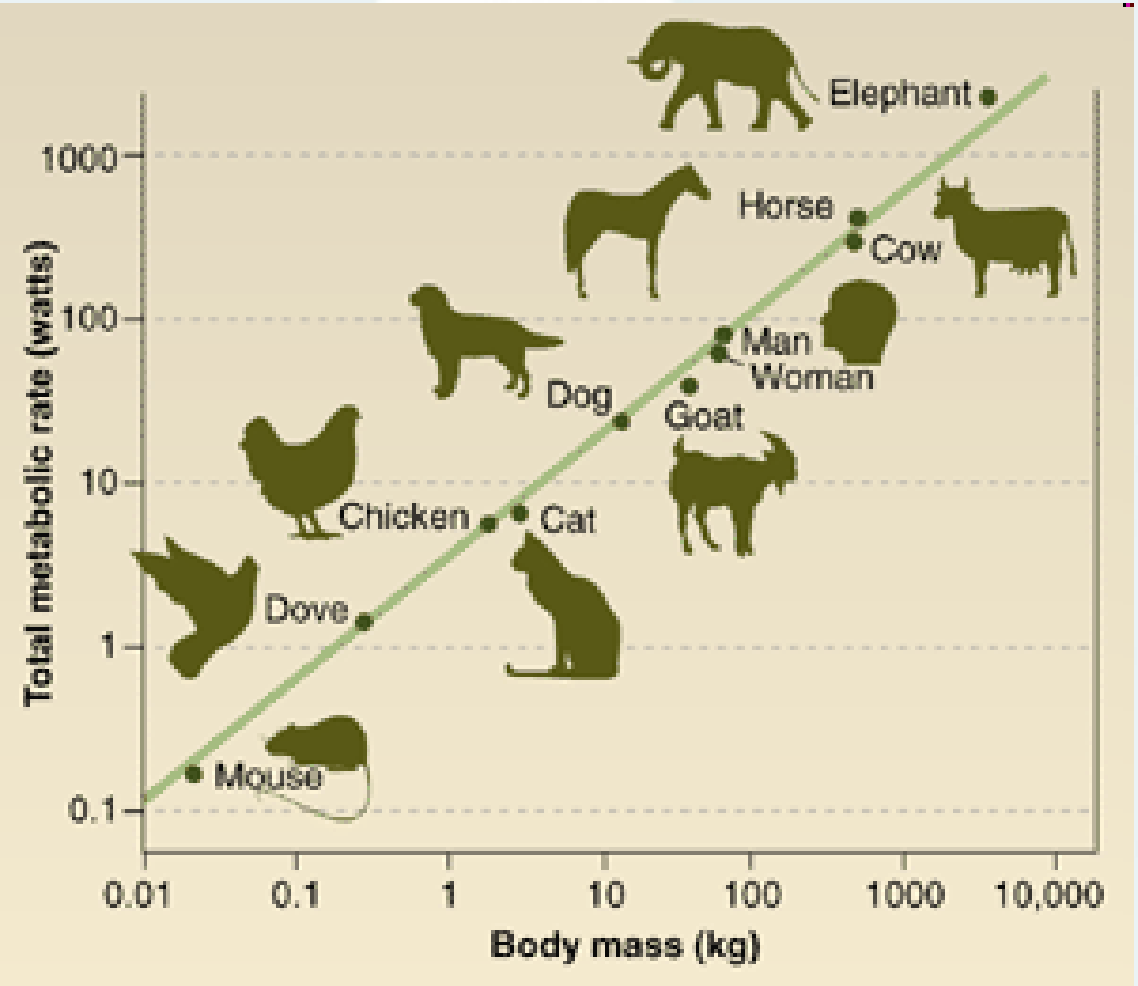
	mysz	chomik	kret	szczur	świnka morska	bóbr górski	królik	kot
c [k					1,04	1,35	2,50	3,30
n [g					5,50	8,10	12,10	25,60
					szympans	owca	człowiek	jaguar
c [k					52,16	55,50	62,00	100,00
mozg [g]	179,00	115,00	56,00	11				
	osioł	świnia	goryl	kr				
cialo [kg]	187,10	192,00	207,00	4(				
mozg [g]	419,00	180,00	406,00	4:				

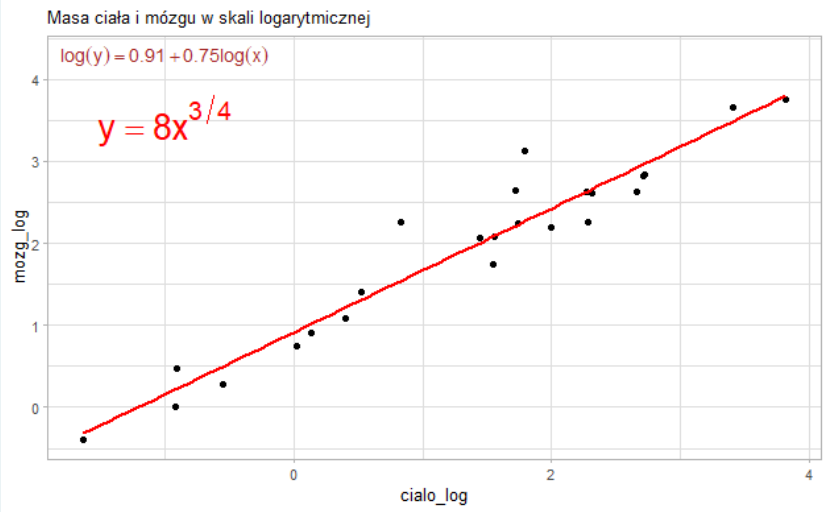





słoń afrykański
słoń azjatycki
człowiek
żyrafa
osioł
koń
szympans
goryl
krowa
owca
świnia
rezus
szary wilk
jaguar
koza
kangur
kot
królik
bóbr górski
świnka morska
kret
szczur
chomik
mysz
1000
100
10
1
mozg
1
100
10000
cialo


Masa ciała i mózgu w skali logarytmicznej
log(y) = 0.91 + 0.75log(x)
y = 8x^3/4
mozg_log
cialo_log
0
1
2
3
4
0
2
4

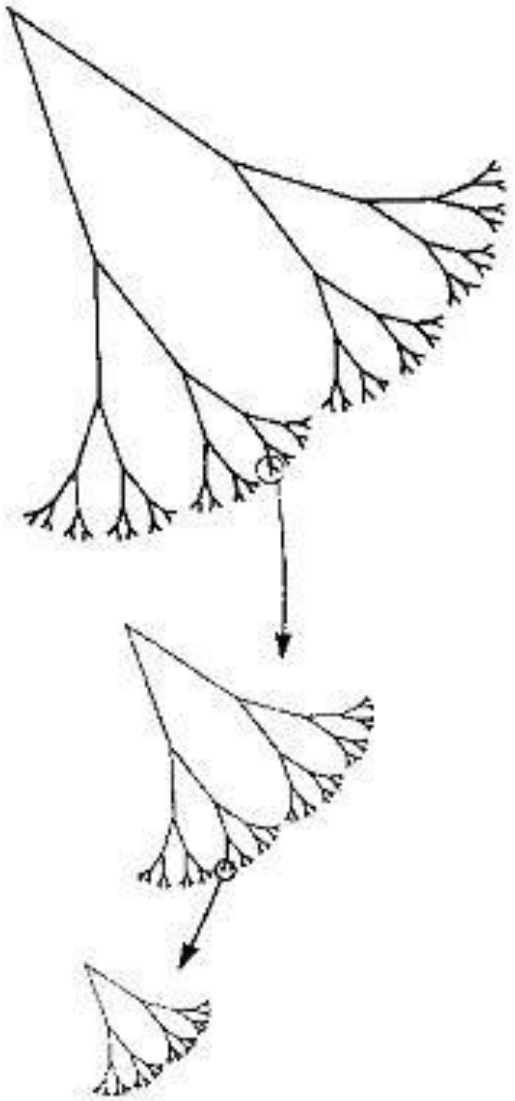




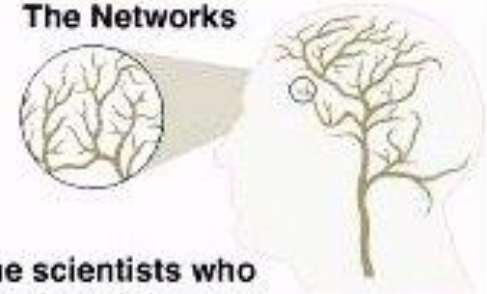
Prawo Kleibera
$y=c\ x^{3/4}$

Dlaczego nie
$y=c\ x^{2/3}$?

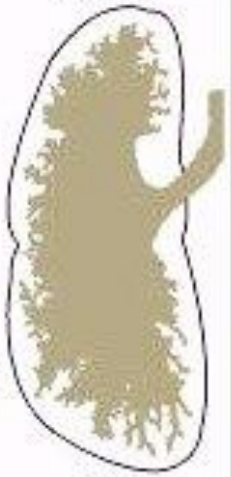
Self-Similar Structure (Fractal)



The Networks



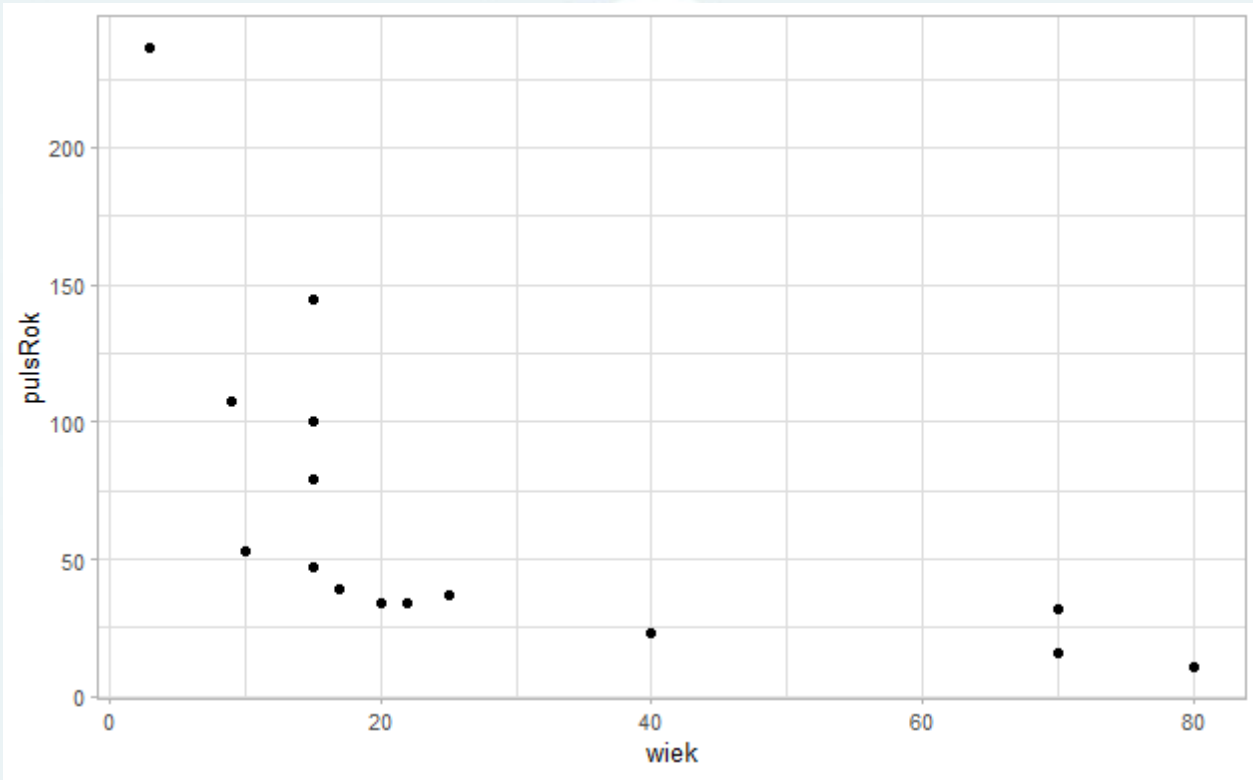
The scientists who developed the scaling theory took clues from naturally occurring networks that carry life-sustaining fluids in organisms in which each small part is a replica of the whole. No matter how big the organism, the ends of these fractal networks are always the same size, since individual cells are of similar size in all organisms.



CIRCULATORY SYSTEM

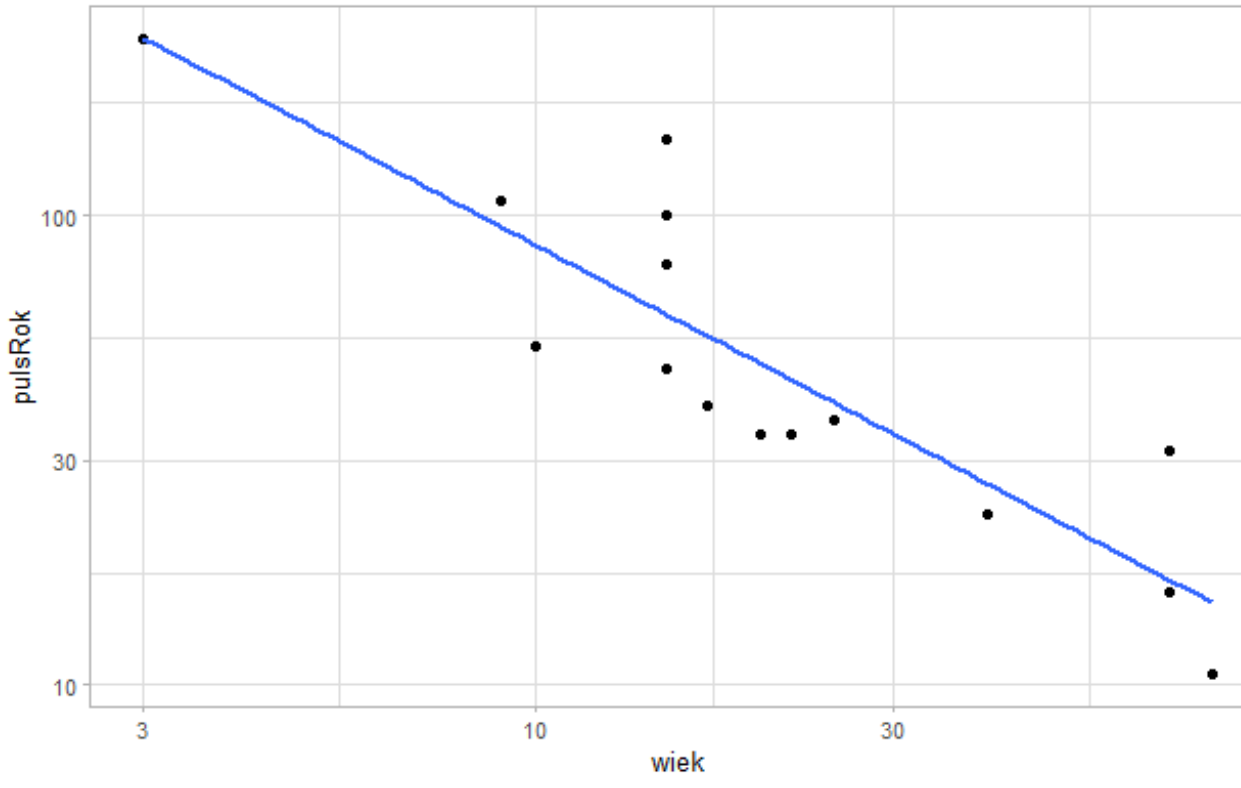
LUNGS

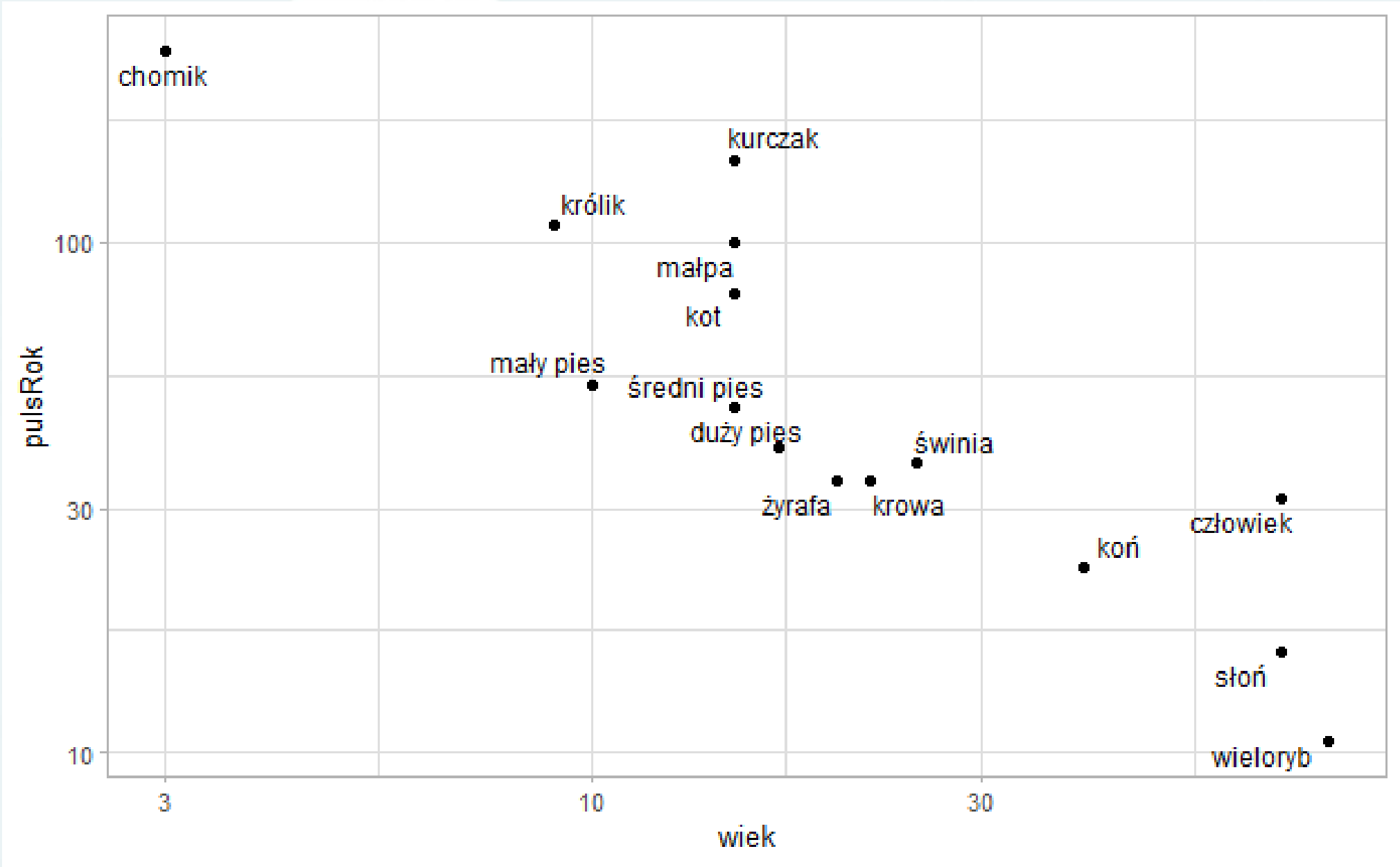
TREE BRANCHES

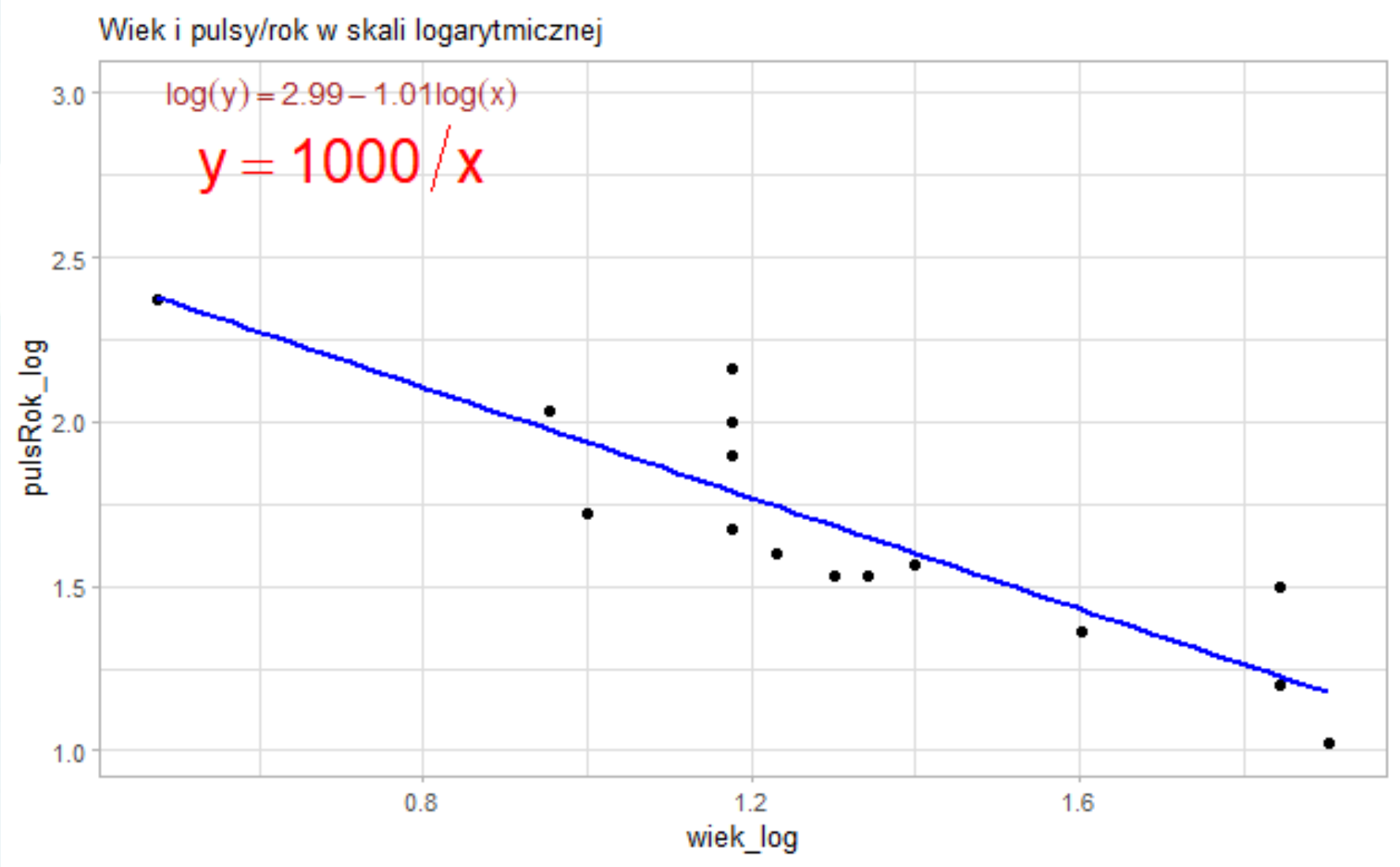


	luży bies	chomik	kurczak	małpa
	5	450	275	190
	9	237	145	100
	.7	3	15	15
	słoń	żyrafa	wieloryb	
	0	65	20	
	.6	34	11	

[min]			
wiek [lata]	40	22	25




chomik
kurczak
królik
małpa
kot
mały pies
średni pies
duży pies
świnia
żyrafa
krowa
człowiek
koń
słoń
wieloryb
100
30
10
pulsRok
3
10
30
wiek



pulsRok=1000/długość życia

Liczba pulsów w całym życiu=długość życia*pulsRok=1000 mln=**miliard**

Aviat Space Environ Med. 1979 Oct;50(10):1037-9.

Similarity in the number of lifespan heartbeats among non-hibernating homeothermic animals.

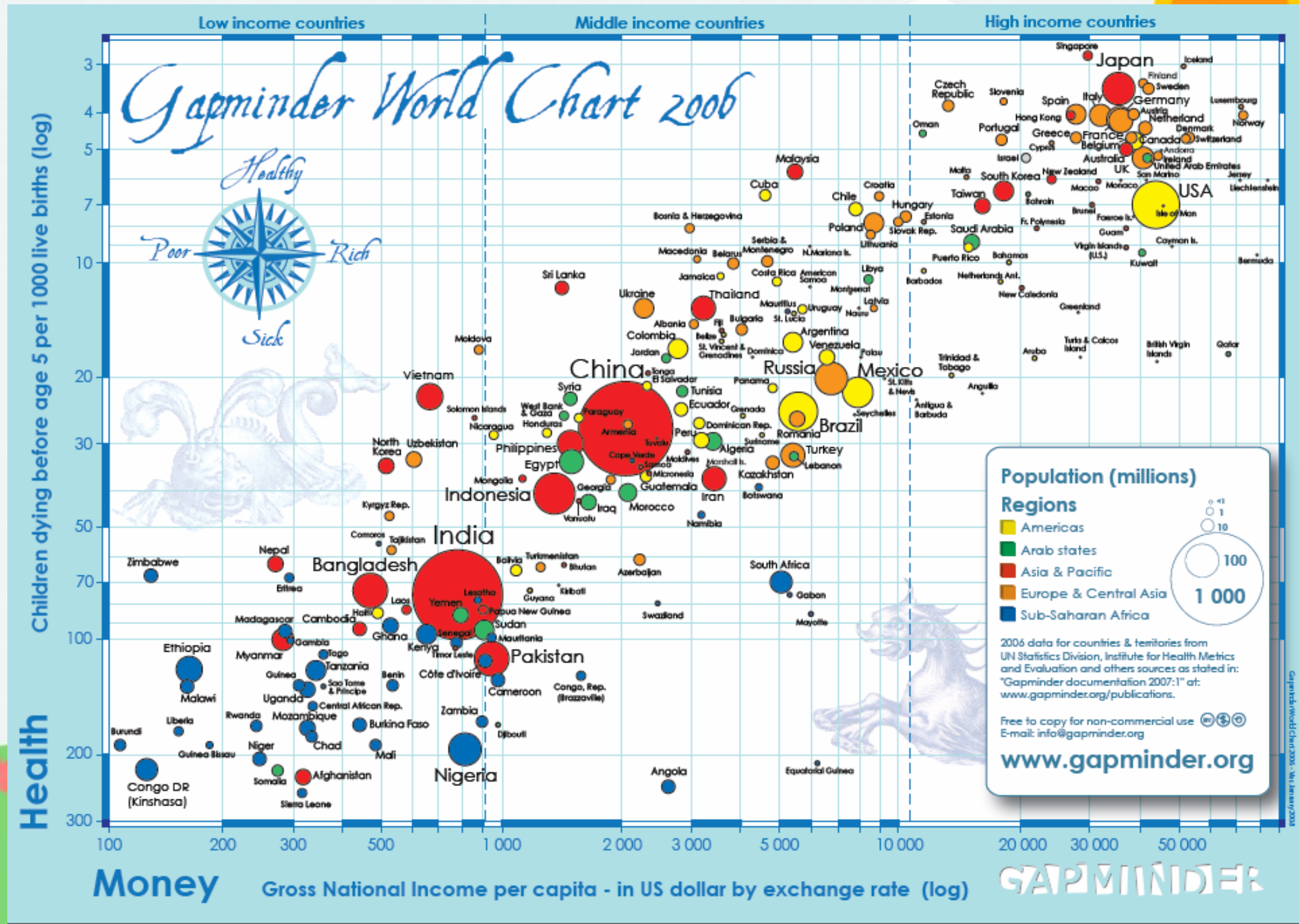
Livingstone SD, Kuehn LA.

Abstract

An investigation was made of the available data on heart rates and maximum lifespan of a number of vertebrates from a variety of sources; only data pertinent to resting adult non-anesthesized homeothermic mammals and birds in a state of thermal neutrality were subsequently analyzed. All known hibernators were excluded because of their extreme, and largely unknown, range of heartbeat from season to season. Plots of heart rate (beats per minute) against reciprocal of lifespan in years showed surprisingly good fits (r = +0.90 for mammals and r = +0.64 for birds). Computation of the total number of heartbeats in the maximum recorded lifespans of the mammalian and avian species involved in this study showed that the mean cumulative heartbeat number for 31 mammalian species was 100 +/- 8 S.E.M. x 10(7) beats and for 23 avian species was 326 +/- 22 S.E.M. x 10(7) beats. This paper documents this analysis, which supports the concept of a close similarity in lifespan heartbeats among mammalian species and among avian species.

PMID: 518447

Ssaki: 1 miliard pulsów w życiu
Ptaki: 3 miliardy pulsów w życiu


Low income countries
Middle income countries
High income countries
Gapminder World Chart 2006
Healthy
Poor
Rich
Sick
Children dying before age 5 per 1000 live births (log)
Health
Money
Gross National Income per capita - in US dollar by exchange rate (log)
3
4
5
7
10
20
30
50
70
100
200
300
100
200
300
500
1 000
2 000
3 000
5 000
10 000
20 000
30 000
50 000
Japan
USA
China
India
Russia
Mexico
Brazil
Indonesia
Pakistan
Nigeria
Bangladesh
Vietnam
Thailand
Ukraine
Argentina
Venezuela
Colombia
Philippines
Egypt
Turkey
Iran
Kazakhstan
South Africa
Ethiopia
Congo DR (Kinshasa)
Population (millions)
Regions
Americas
Arab states
Asia & Pacific
Europe & Central Asia
Sub-Saharan Africa
1
10
100
1 000
2006 data for countries & territories from UN Statistics Division, Institute for Health Metrics and Evaluation and others sources as stated in: "Gapminder documentation 2007:1" at: www.gapminder.org/publications.
Free to copy for non-commercial use
E-mail: info@gapminder.org
www.gapminder.org
GAPMINDER