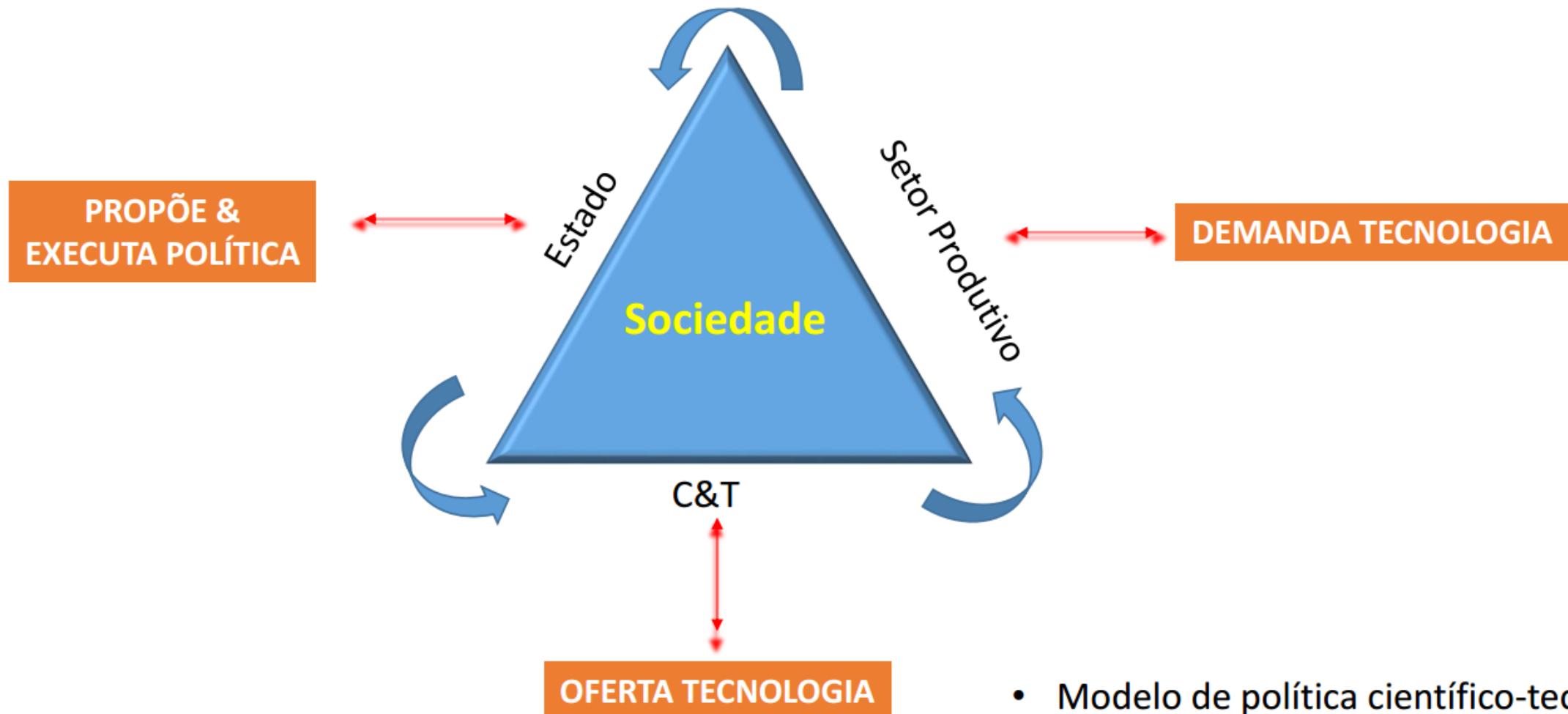


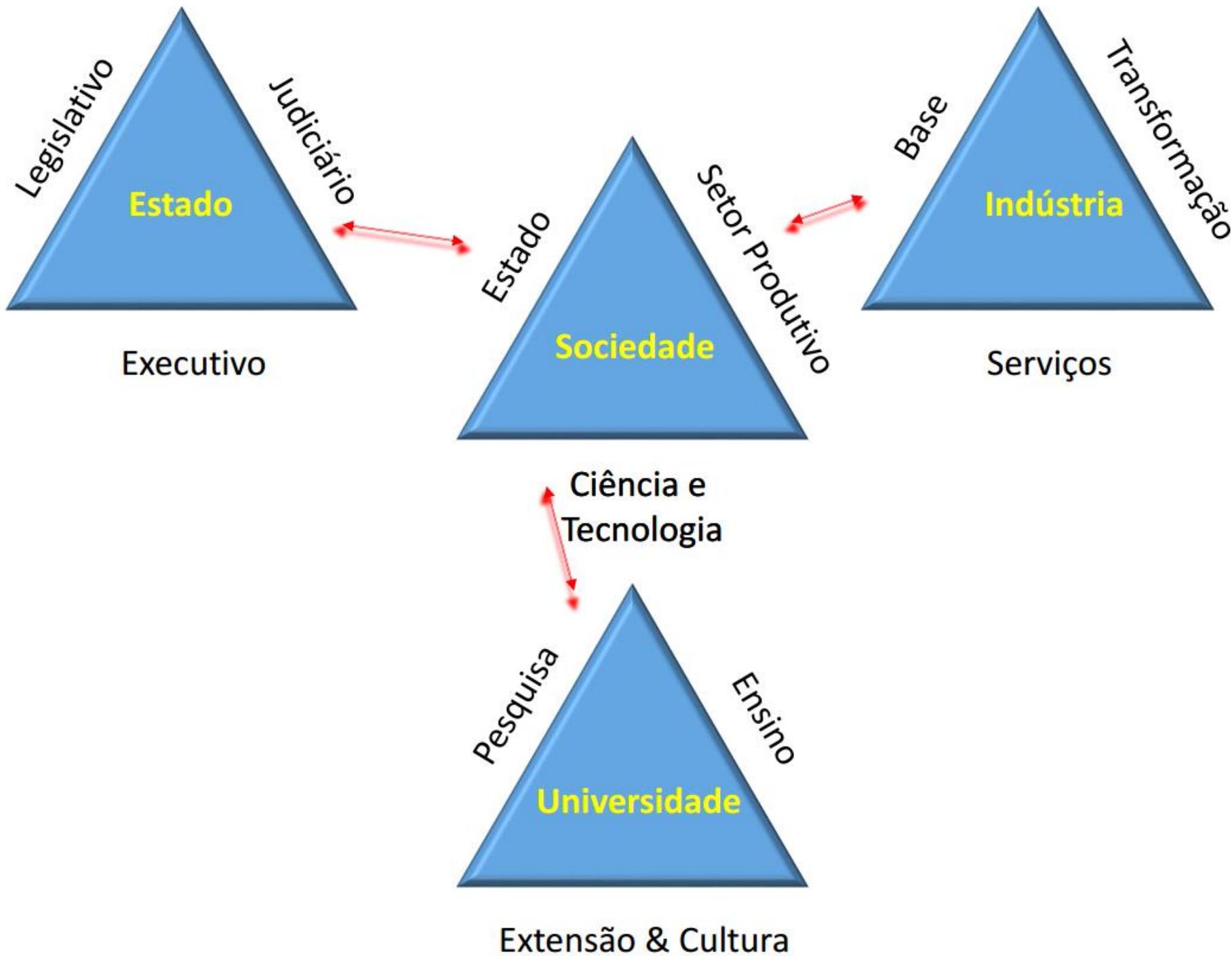
VIBRAÇÕES

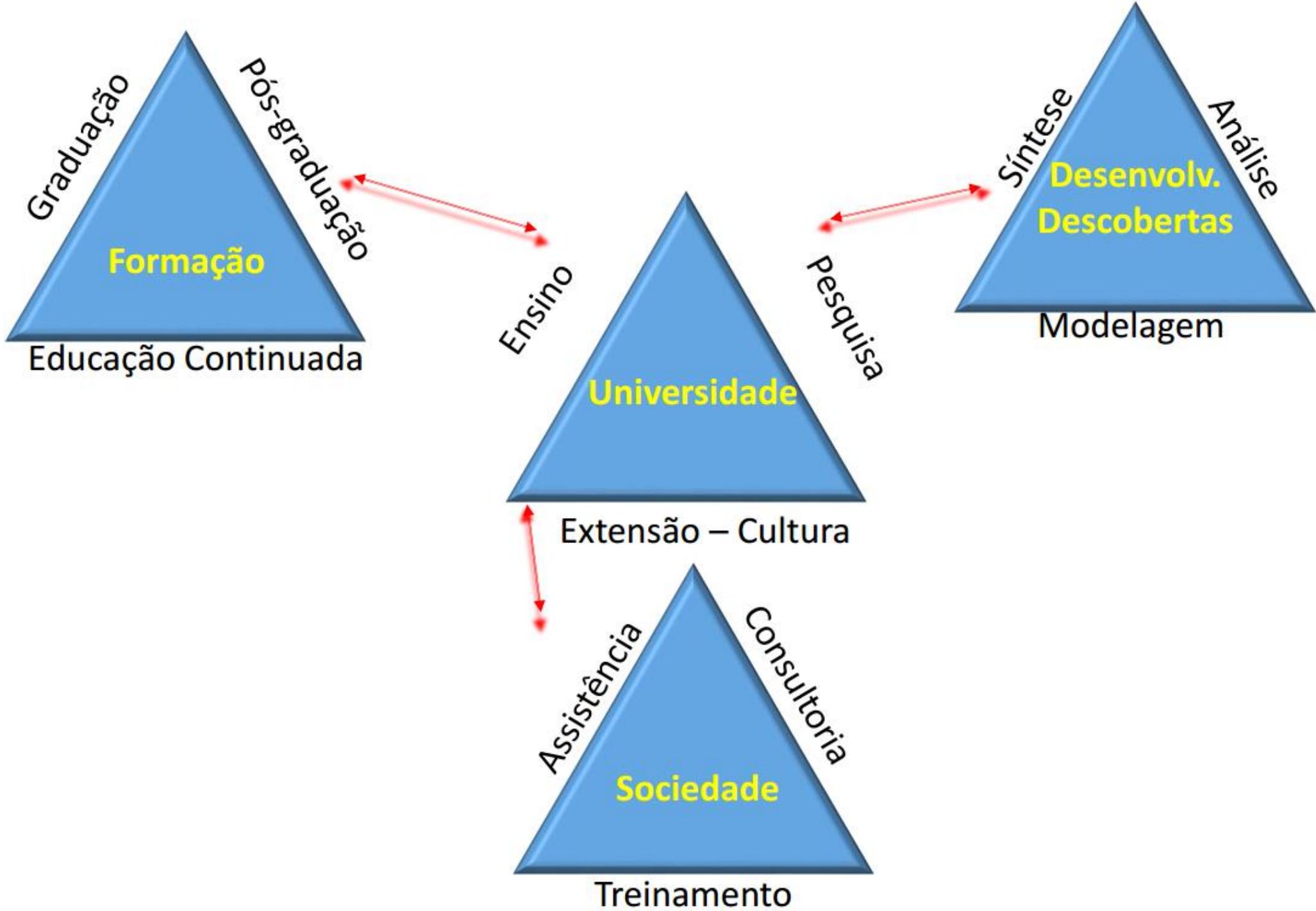
- 1GL
- 2GL
- Hastes
- Vigas
- Aula expositiva
- P3 / testes / trabalho ?
- maralves@usp.br

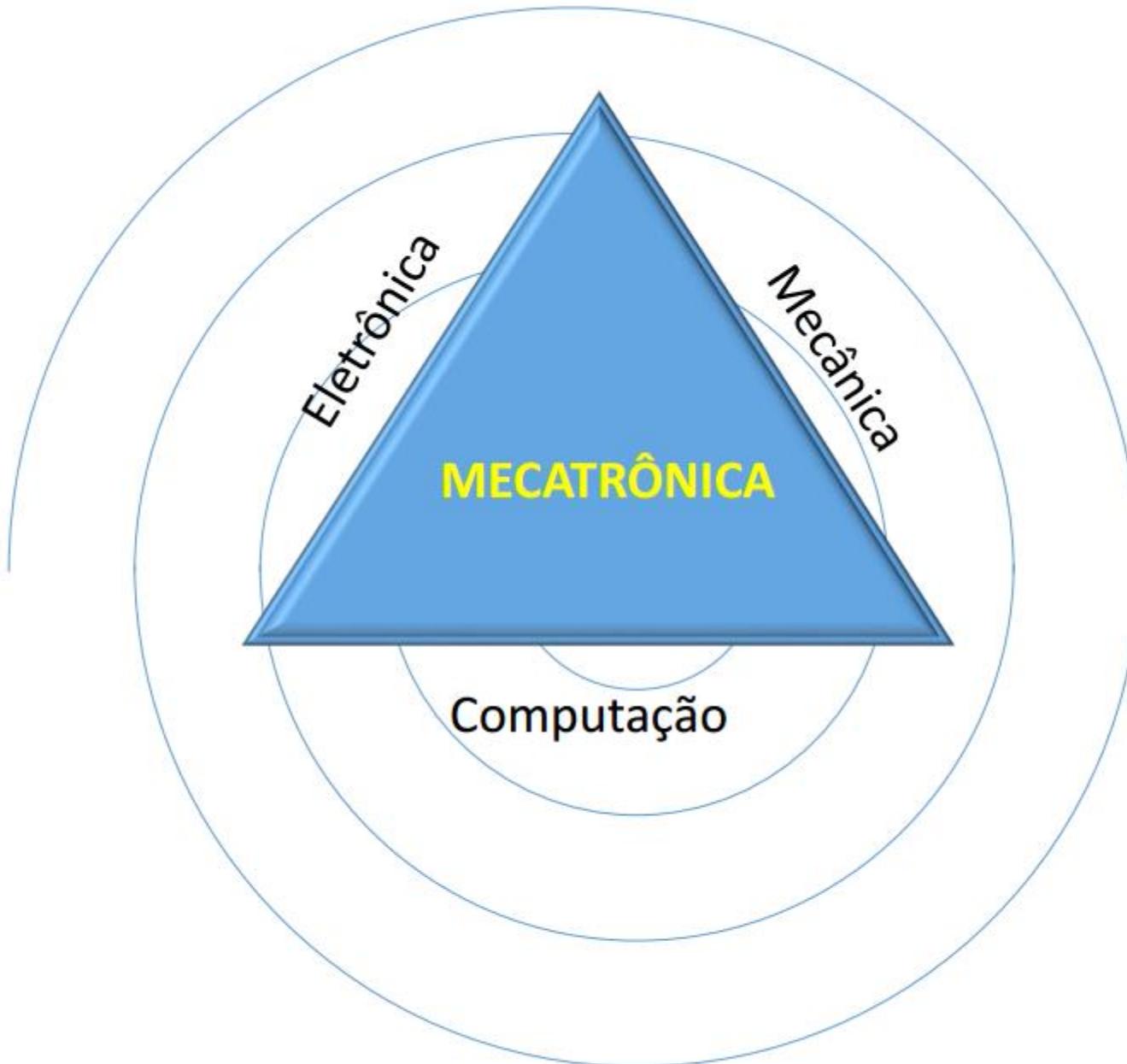
Triângulo de (Jorge) Sábato / (John) Galbraith



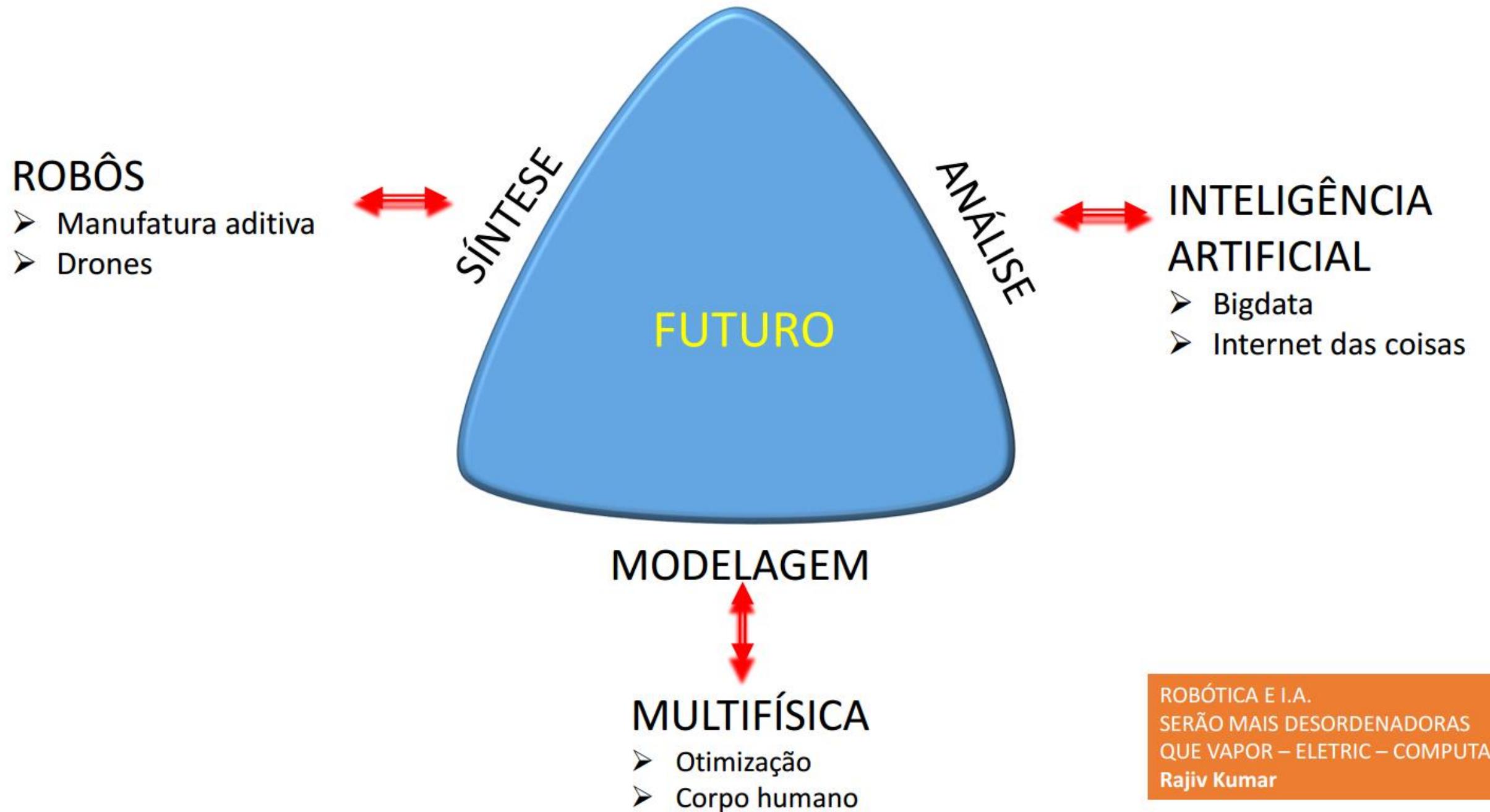
- Modelo de política científico-tecnológica
- Estratégia para desenvolvimento países com setores industriais dependentes
- Mais atual é o conceito de “hélice tripla”





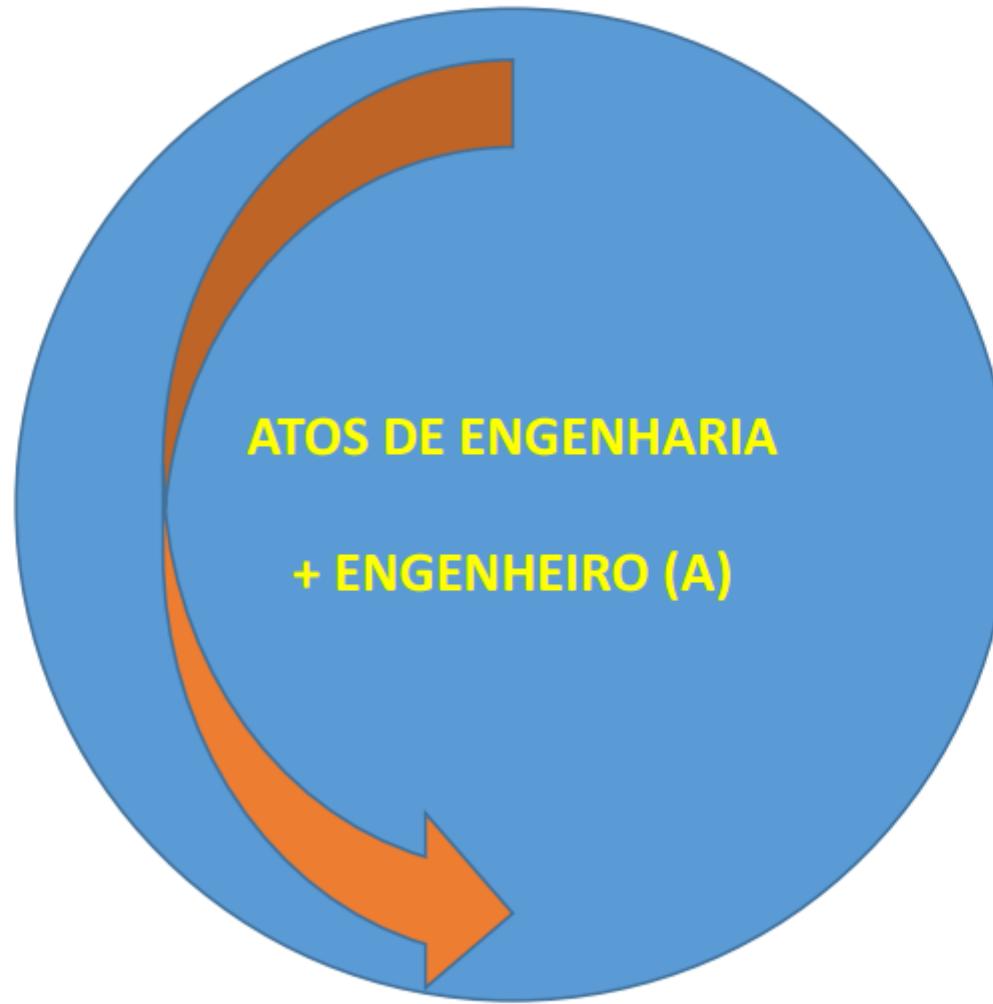


SINERGIA



ROBÓTICA E I.A.
SERÃO MAIS DESORDENADORAS
QUE VAPOR – ELETRIC – COMPUTADOR
Rajiv Kumar

CRIATIVO e EMPREENDEDOR



Sinergia

REFLEXIVO



SÍNTESE INTERDISCIPLINAR: nano-balança

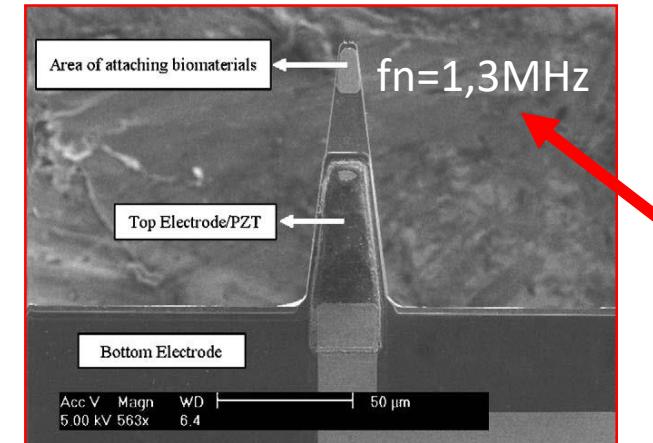


Dimensões típicas:

H=0,2-1μm

B=20-100μm

L=100-500μm



- Viga opera na freqüência natural via circuito oscilador
 - Anticorpo anti-insulina é immobilizado no sensor
 - Sensor é imerso na solução teste
 - Insulina se liga ao anticorpo aumentando massa
 - Insulina é detectada por um contador de freqüência.
- $\Delta f=217\text{Hz}$, $\Delta m=0,45821\text{E-}15\text{g}$
- contra $0,595\text{E-}15\text{g}$ experimental

Interdisciplinar: modelagem e análise do coração humano: mec. + elétr. + fluidos

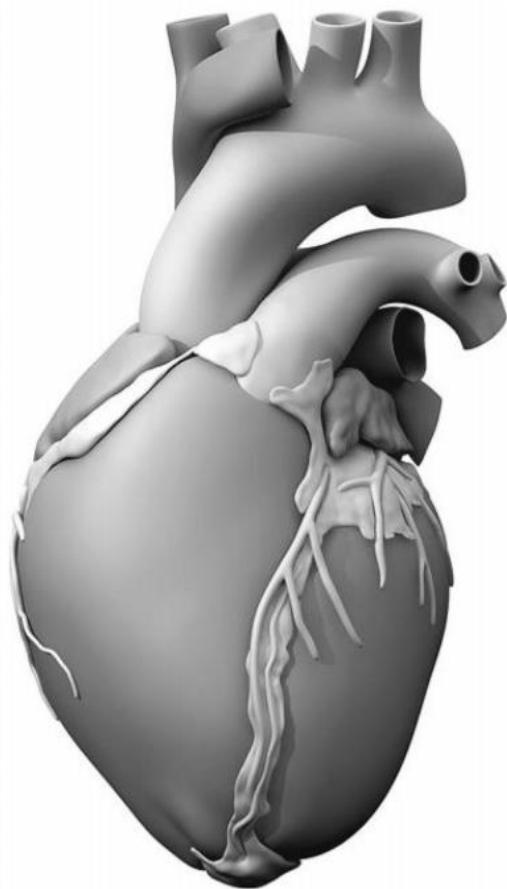


FIGURE 1. Solid model of the human heart used as the basis for our improved model. It was created from computed tomography and magnetic resonance imaging; adapted with permission from (Zygote Media Group and Inc., 2014).



Cardiovascular Engineering and Technology / © 2013
DOI: 10.1007/s13235-013-0164-z

Human Cardiac Function Simulator for the Optimal Design of a Novel Annuloplasty Ring with a Sub-valvular Element for Correction of Ischemic Mitral Regurgitation

BRIAN BAILLARGEON,¹ IVAN COSTA,² JOSEPH R. LEACH,³ LIX CHUAN LEE,⁴ MARTIN GENET,^{5,6}
ARNAUD TOUTAIN,⁶ JONATHAN F. WENK,⁷ MANUEL K. RAUSCH,⁸ NUNO REBELO,¹
GABRIEL ACEVEDO-BOLTON,^{3,8} ELLEN KUHL,⁸ JOSE L. NAVIA,⁹ and JULIUS M. GUCCIONE,^{6,10}

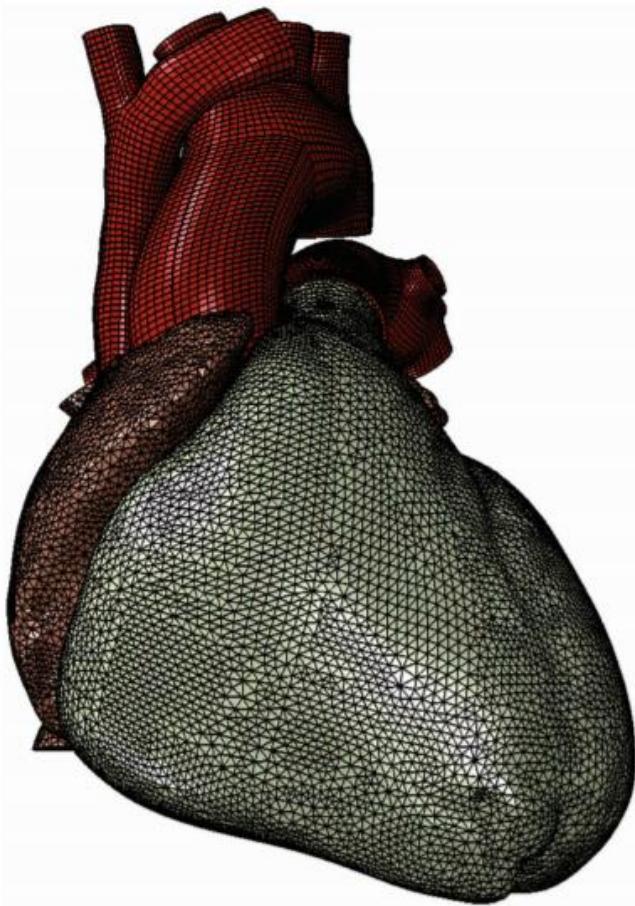
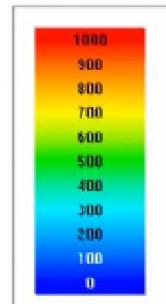


FIGURE 4. Mechanical finite element model of the human heart discretized with 449,560 linear tetrahedral elements, 12,915 linear quadrilateral shells, 7577 linear triangular shells, 636 linear truss elements, 16,824 rigid triangular elements, 130,290 nodes, and 443,564 mechanical degrees of freedom.

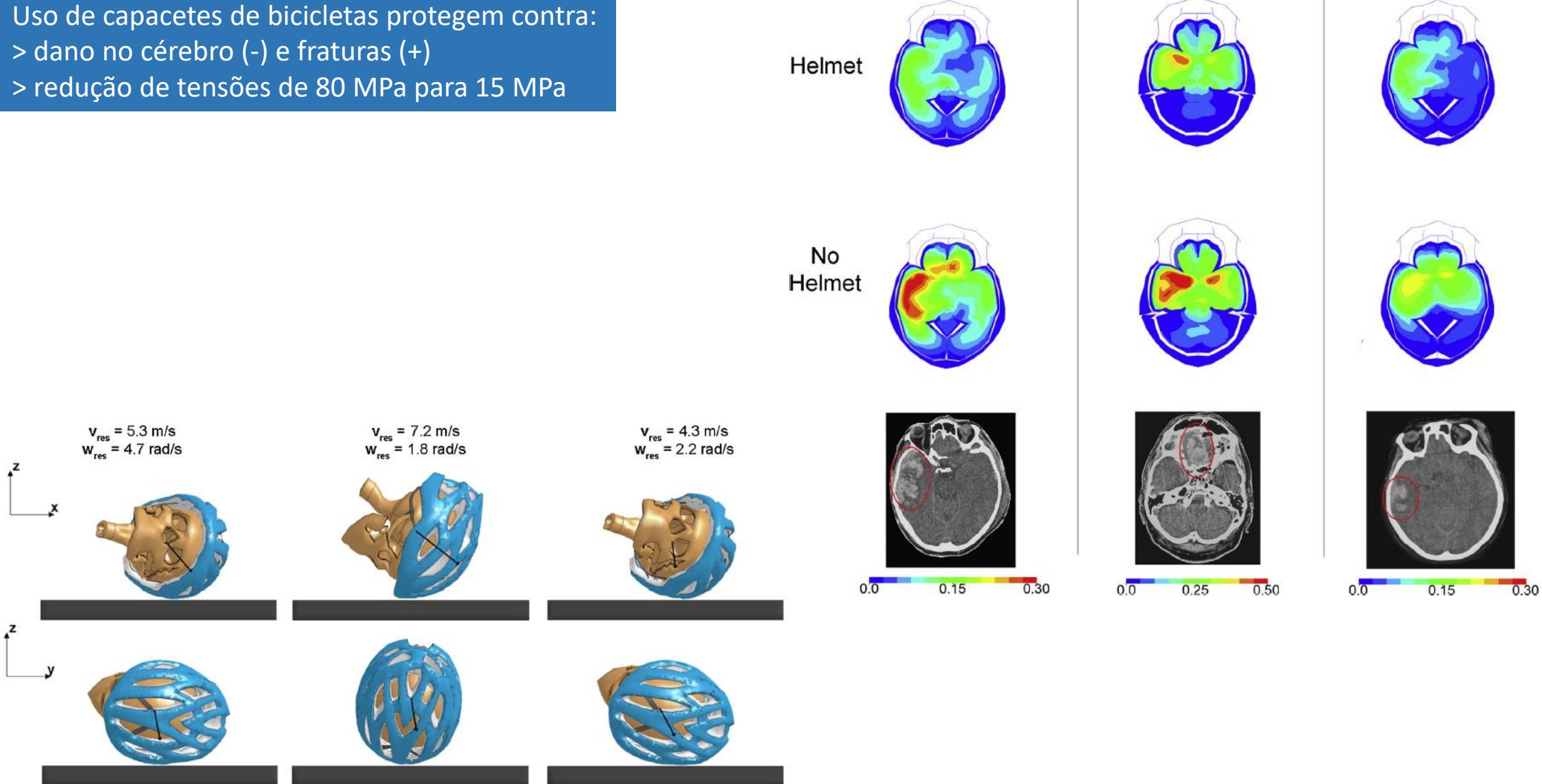


The
Living
Heart
Project



Velocity
[mm/s]

Uso de capacetes de bicicletas protegem contra:
 > dano no cérebro (-) e fraturas (+)
 > redução de tensões de 80 MPa para 15 MPa



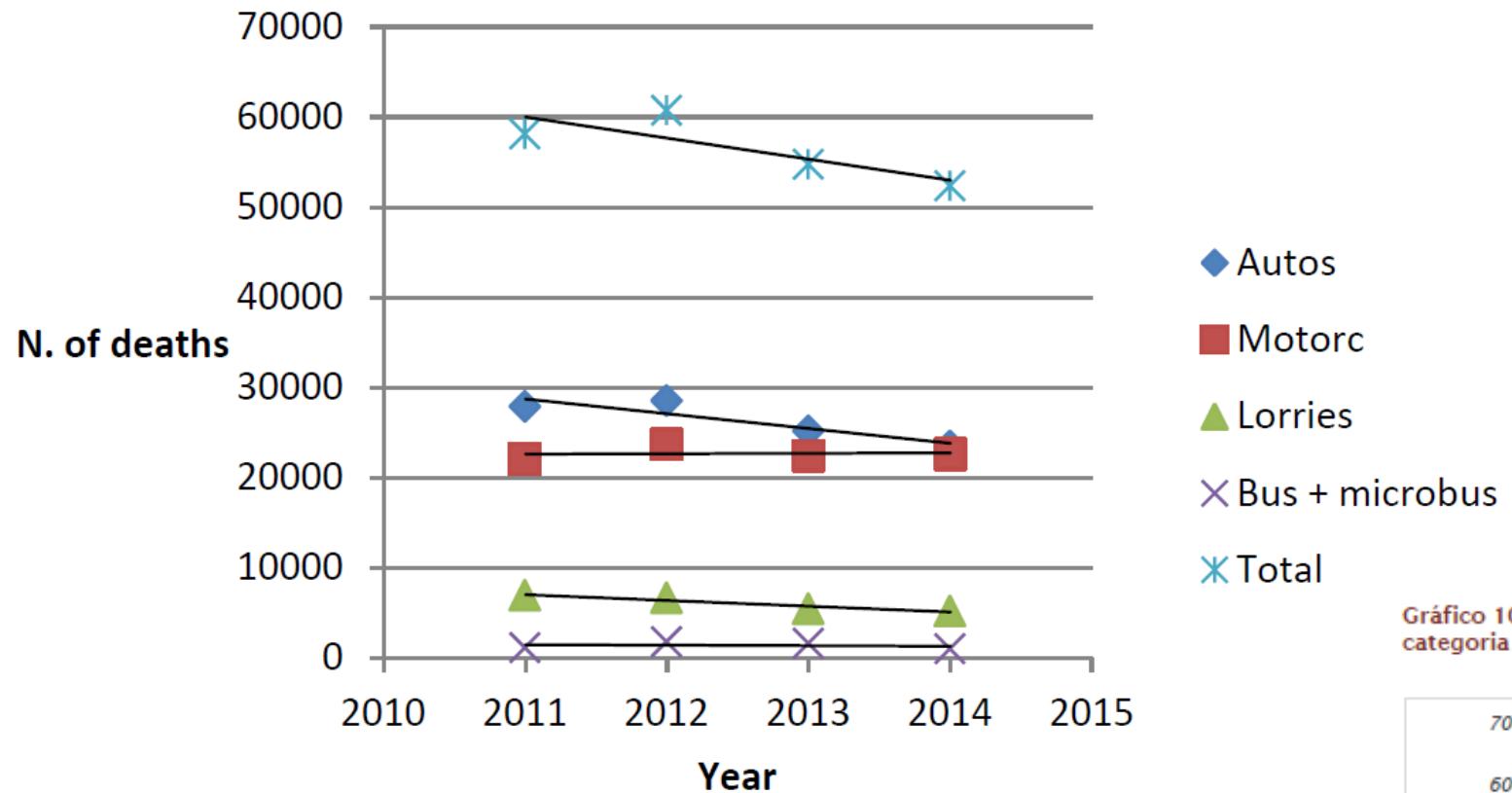
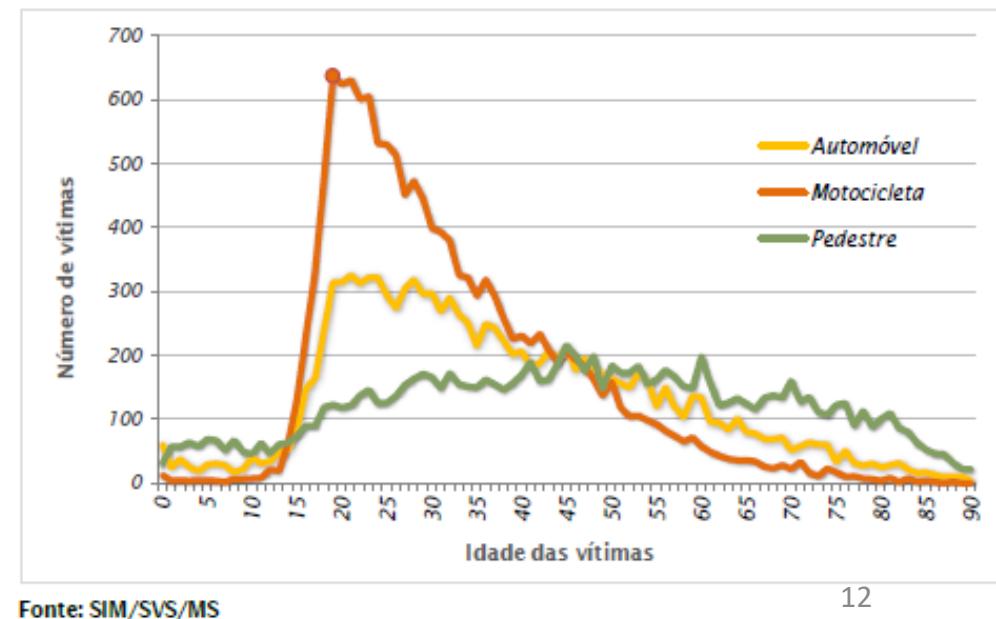
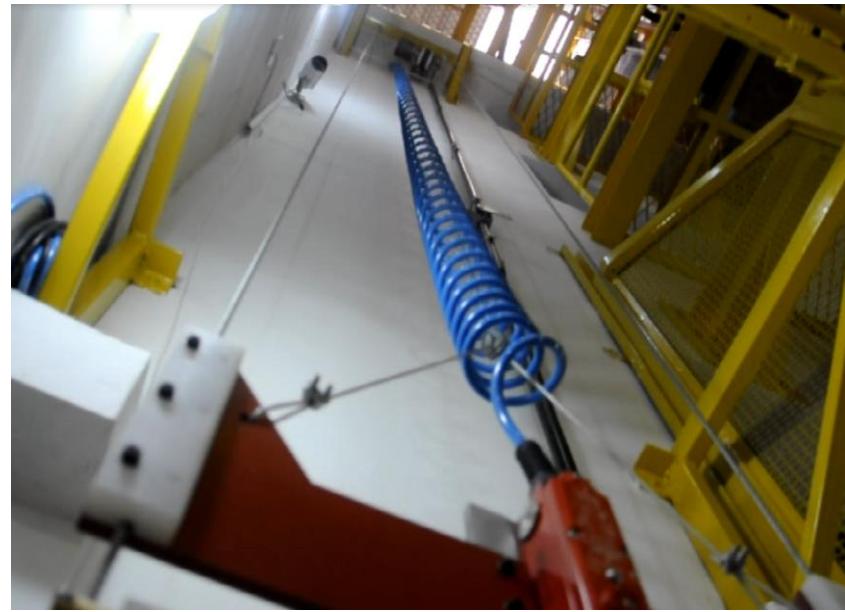


Gráfico 10.1.1. Número de óbitos em acidentes de trânsito por idades simples e categoria 1. Brasil. 2011.





UN BRASIL

27.0 km/h = 7.5 m/s

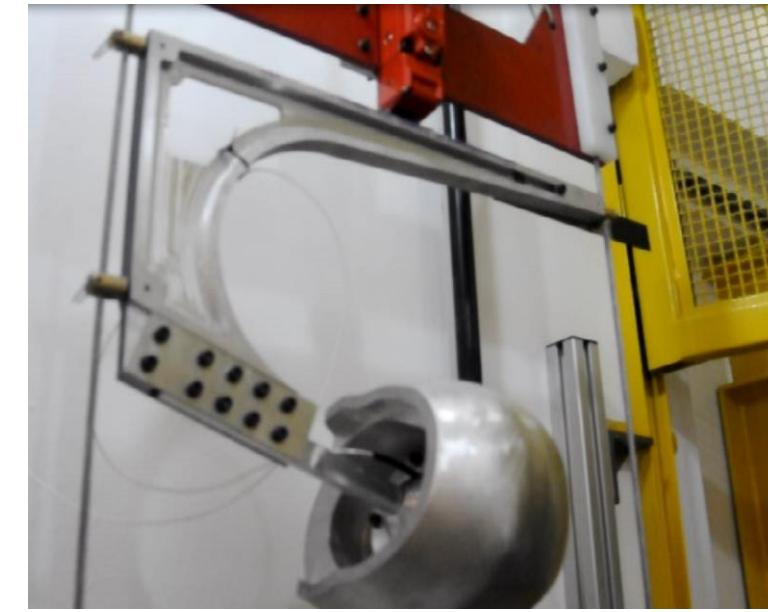
25.2 km/h = 7.0 m/s

a_max = 275 g e HIC < 2400

a_max = 300 g e < 150 g @ 5 ms

Flat + Kerbstone R = 15 mm

Flat + Hemispherical R = 50 mm



Type	Origin	EXPEC RESULTS
AGV K3	IMP	★★★★
Shark S700	IMP	★★★★★
LS2 FF358	IMP	★★★★
Protork Evolution 3G	BR	★★★★
EBF Rox	BR	0
Taurus San Marino	BR	0
EBF E8	BR	0
NORISK FF391	IMP	0
Protork Liberty 4	BR	-
Taurus Zaref	BR	0



Modelagem Análise Síntese

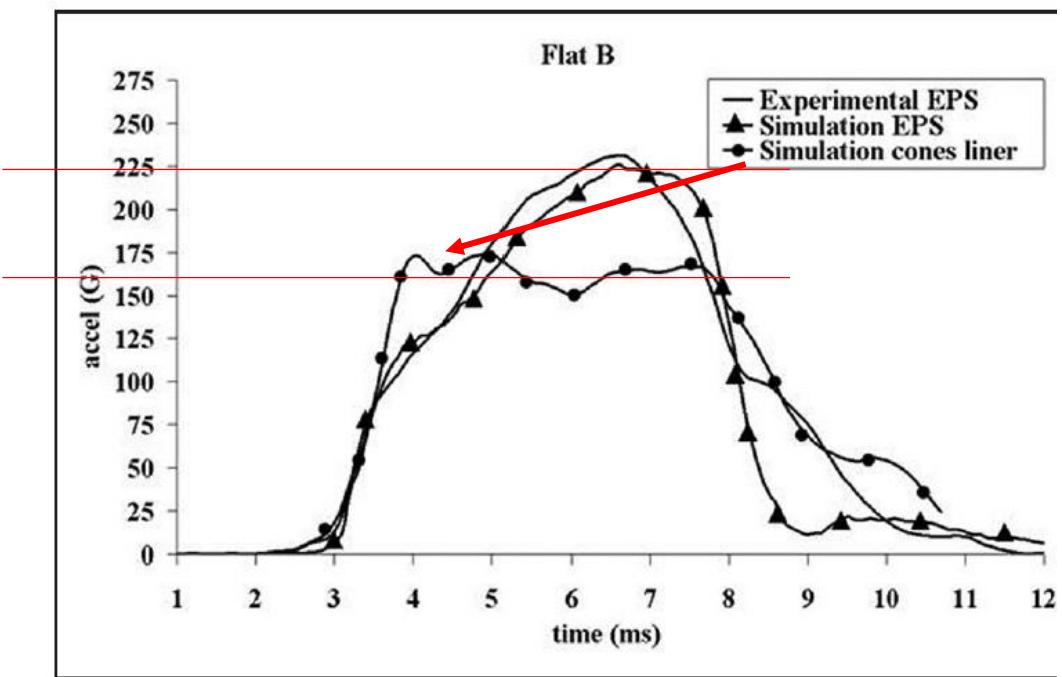
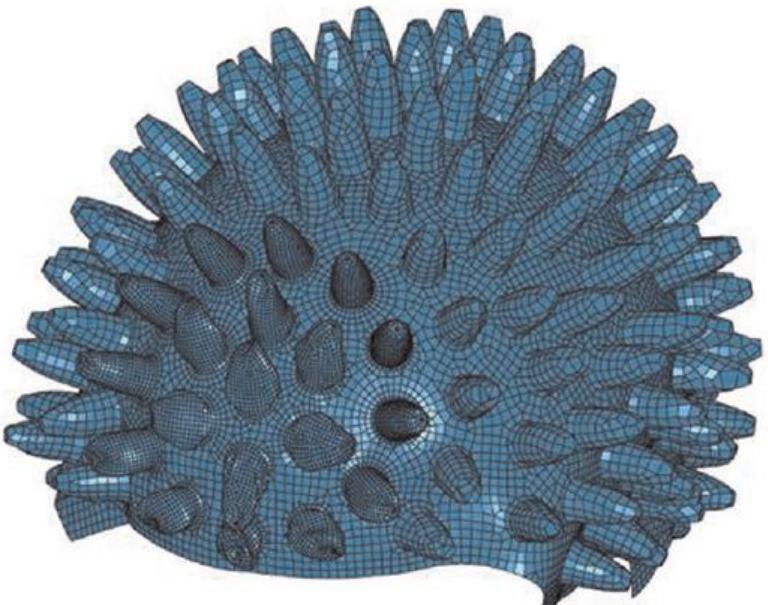
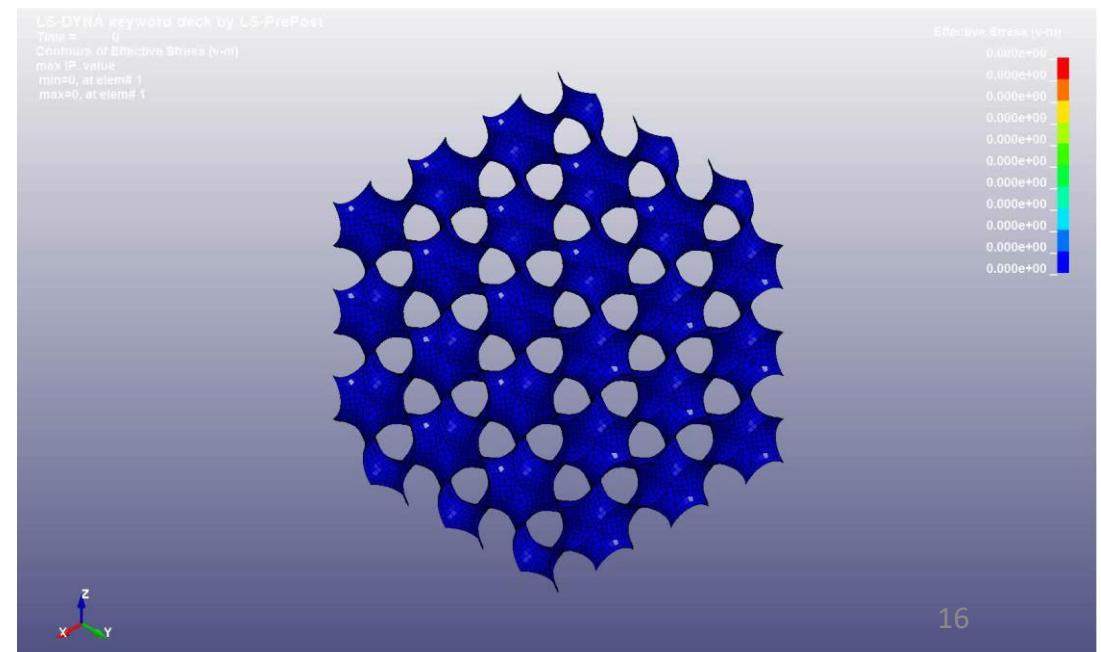
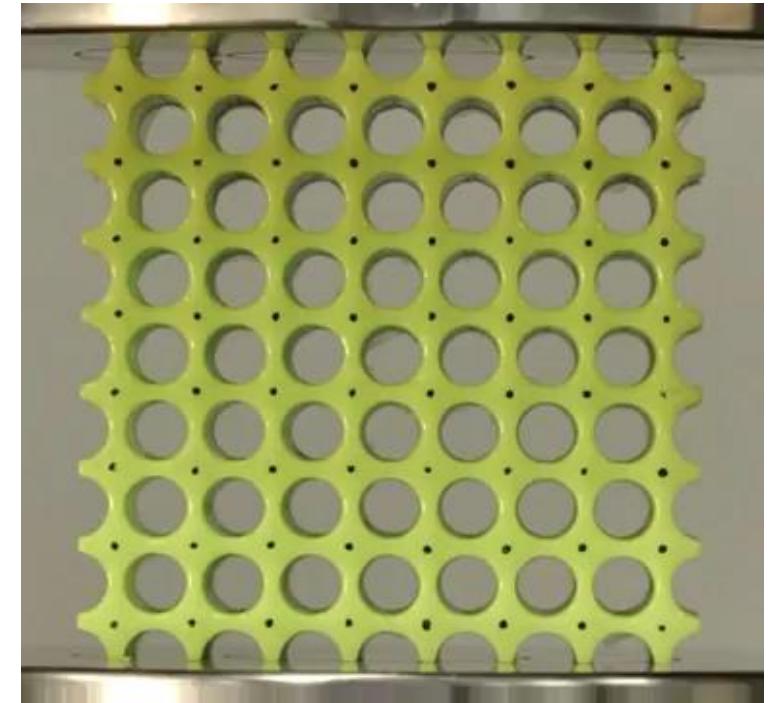


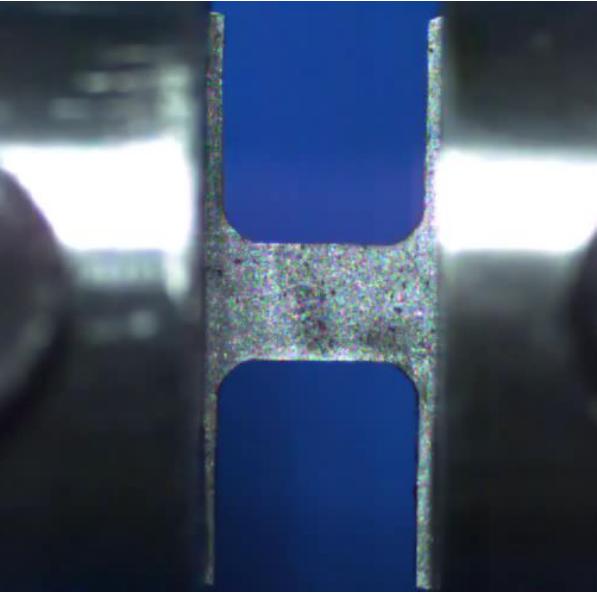
Figure 17. Comparison between experimental and numerical data for impact at point B.
EPS: expanded polystyrene.

Metamateriais [futuro]

Metamateriais: propriedades macroscópicas vêm + de sua subestrutura e – da composição química



Barra de Hopkinson: síntese como um *ato de engenharia*



FASTCAM-APX RS 25...

30000 fps

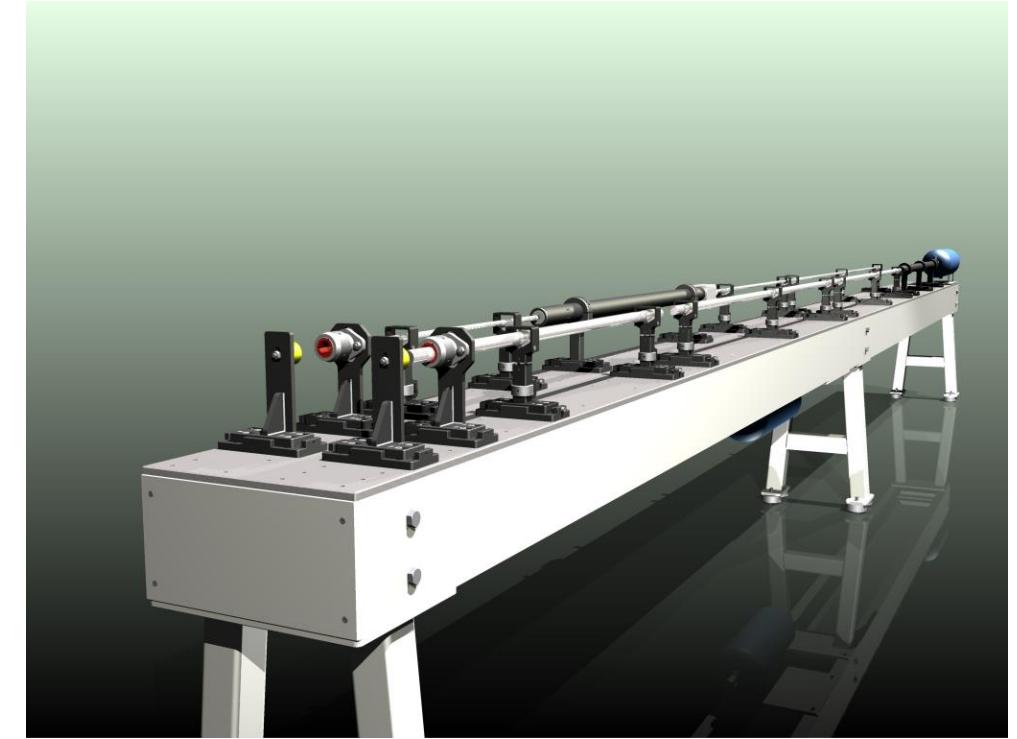
1/30000 sec

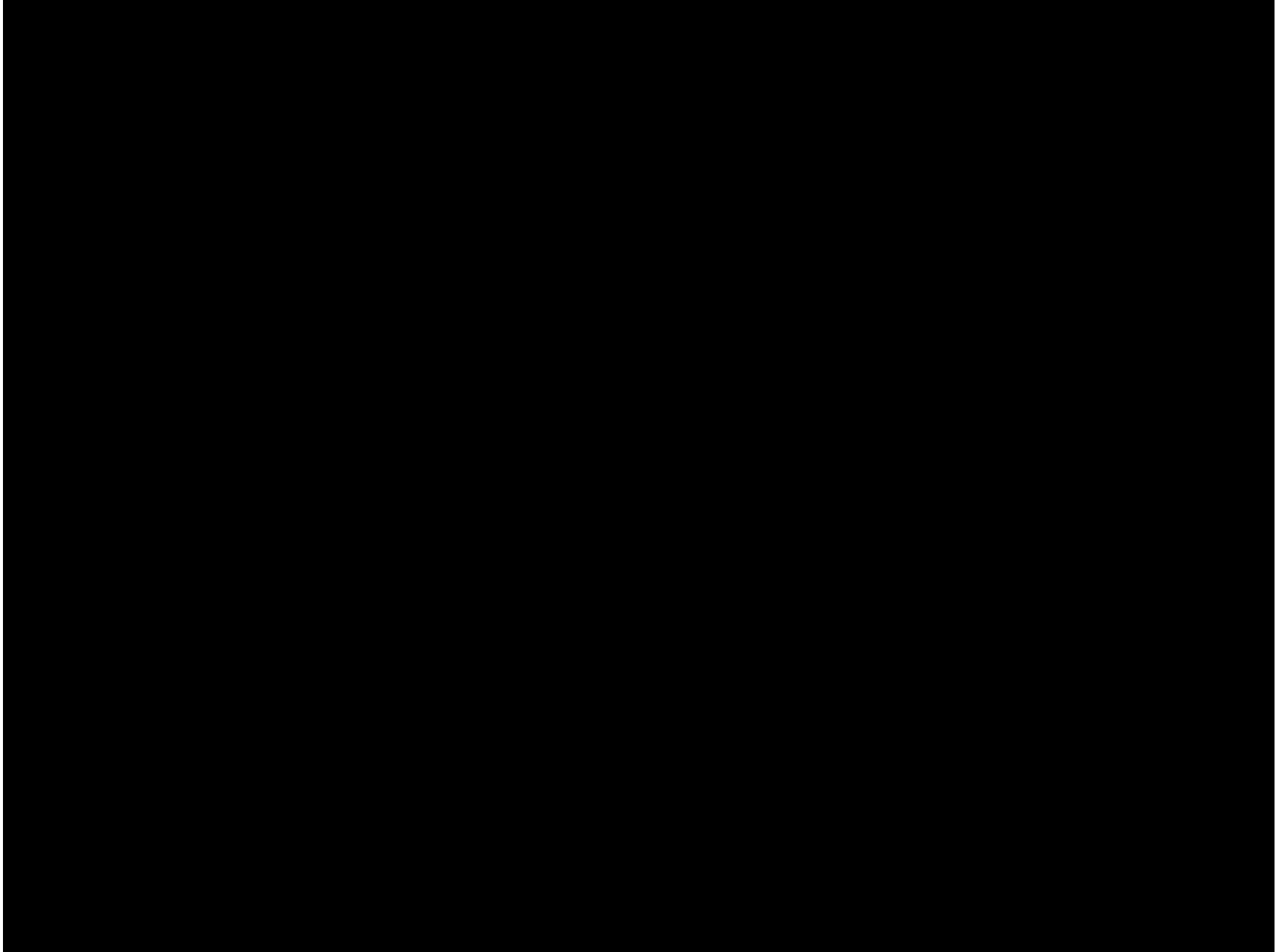
384 x 176

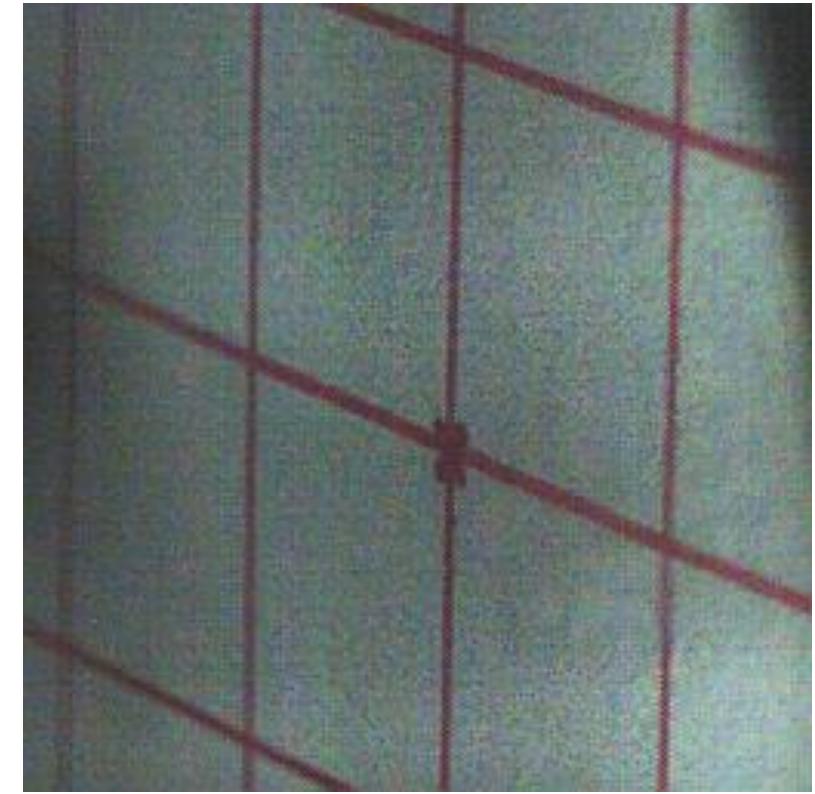
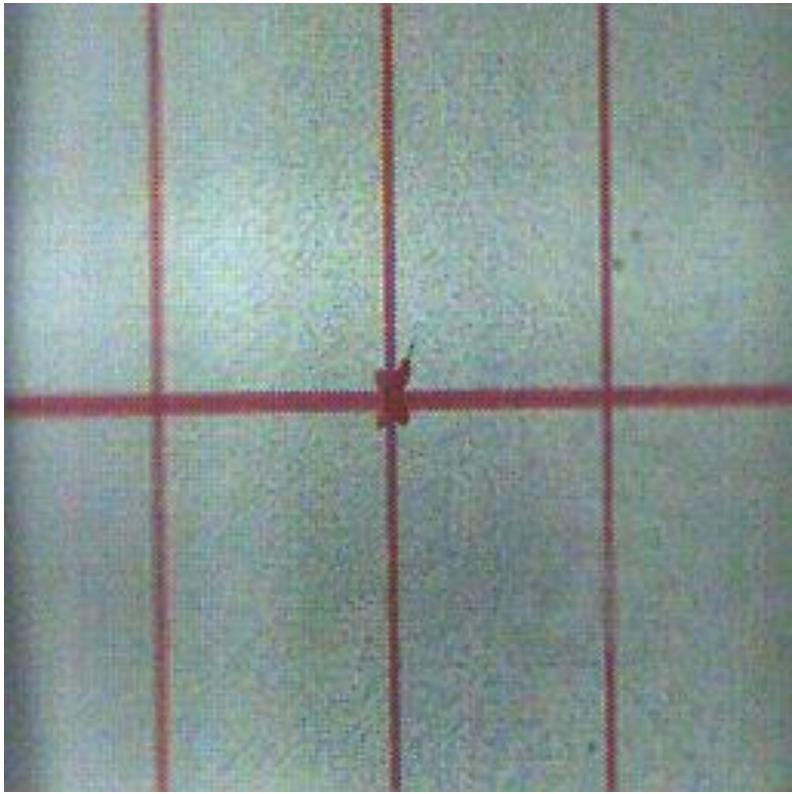
frame : -11600

-00:00:00.386667sec

Photron

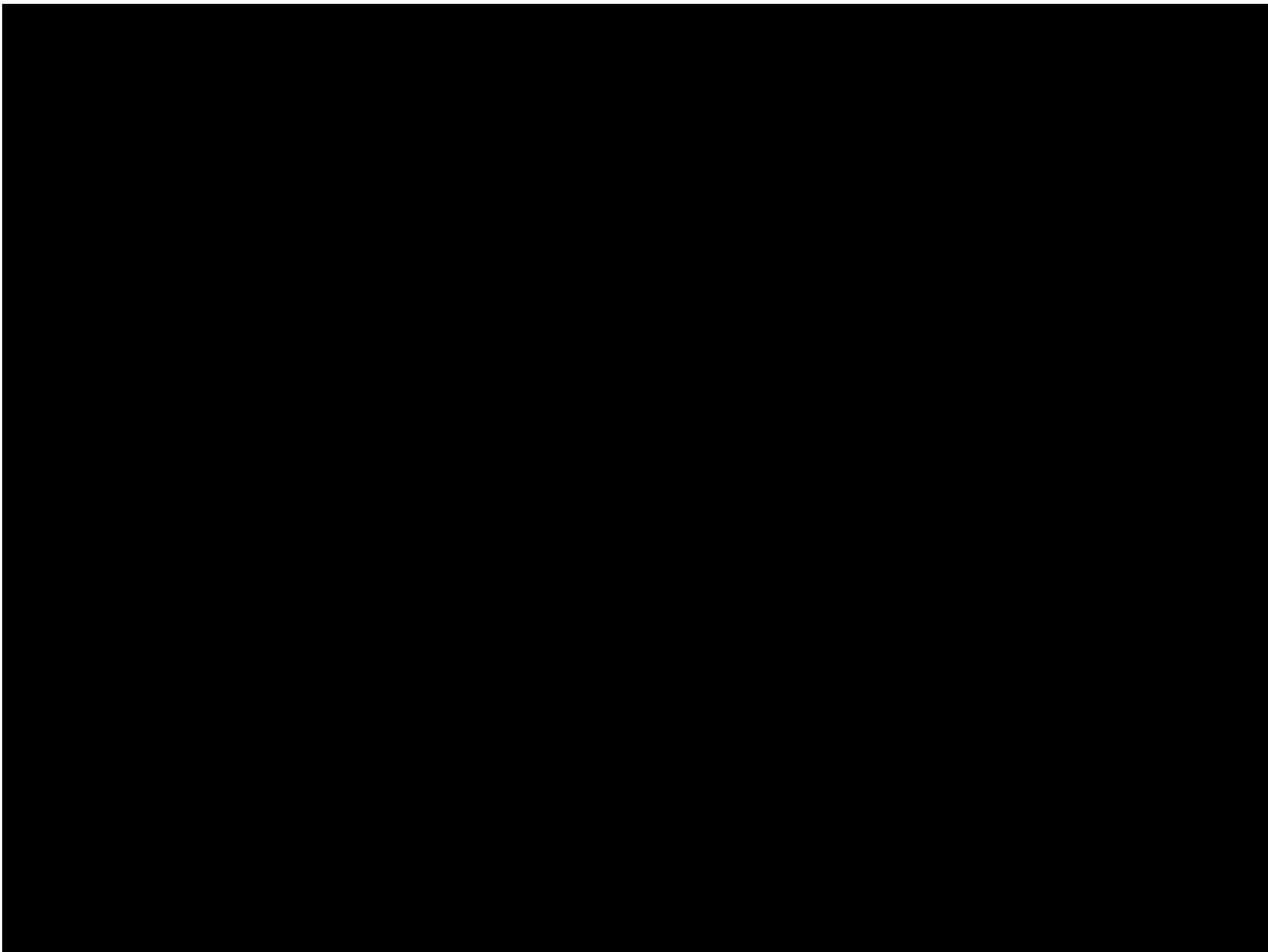






STORY OF THE MERRIMACK BRIDGE

- 1942 -



https://www.youtube.com/watch?v=eAXVa_XWZ8

<https://www.youtube.com/watch?v=gQK21572oSU> London bridge opening

The Resonant Bridge

**by Bob Barrett
Messiah College
Box 3041
Grantham PA 17027 USA**



[youtube.com/brusspup](https://www.youtube.com/watch?v=uENITui5_jU)

https://www.youtube.com/watch?v=uENITui5_jU water hose

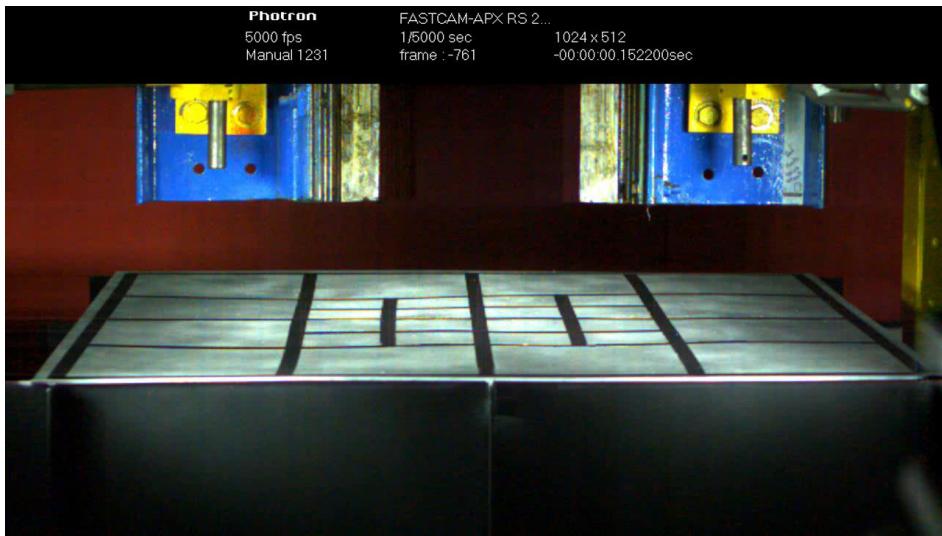
<https://www.youtube.com/watch?v=wvJAgrUBF4w> plate vibration

All of the experiments
in this video are real.

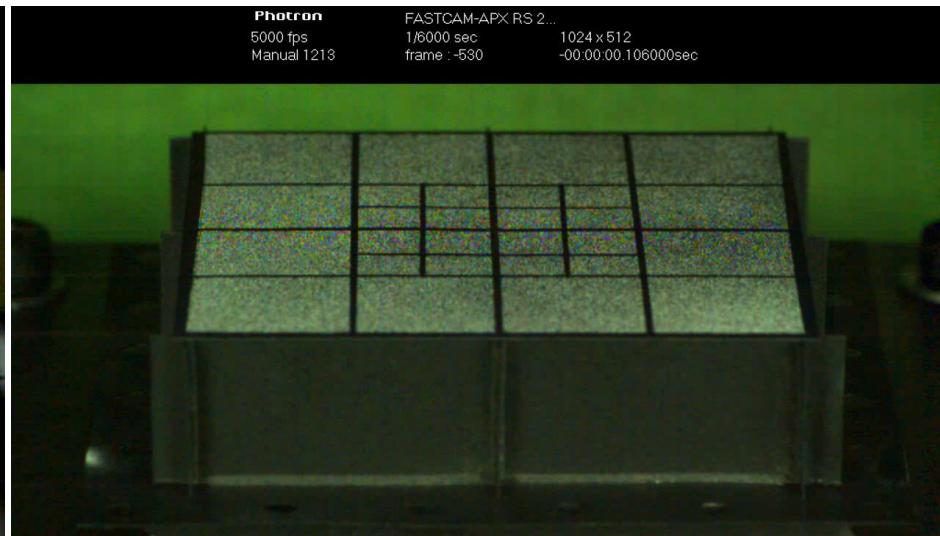
<https://www.youtube.com/watch?v=Q3oltpVa9fs#t=10> cynematics

<https://www.youtube.com/watch?v=dao0mbAbNLE> watch





1 m
prototype



83 mm
model





Trabalho do músculo convertido para salto, com g afetando modelo e protótipo

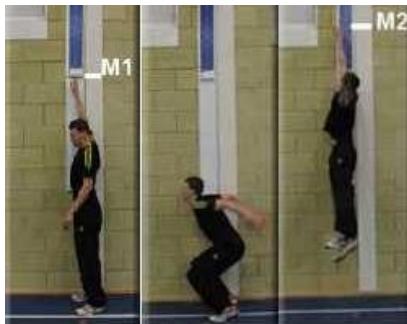
$$E_P = mgh$$

$$W = Fd$$

$$E_P = W$$

$$h = \frac{Fd}{mg}$$

$$h \propto \frac{L^2 L}{L^3} \propto L^0$$



70 kg

70 cm



3 g

59 cm



40 mg

30 cm



0,49 mg

20 cm

Todos os animais, conquanto de mesmo estilo, com suas alavancas na mesma proporção, devem saltar não à mesma posição relativa, mas à mesma posição de fato.

- Altura do salto não depende da massa
- Peso difere por mais de 100 milhões

FIG. 10

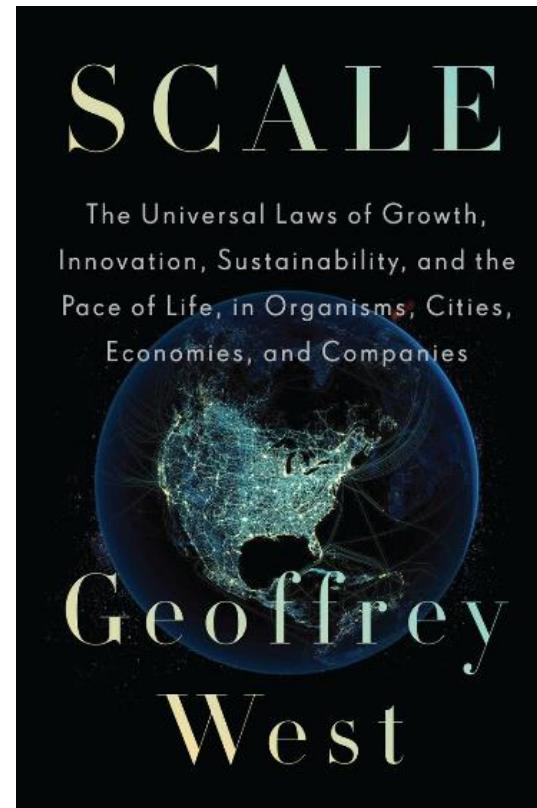
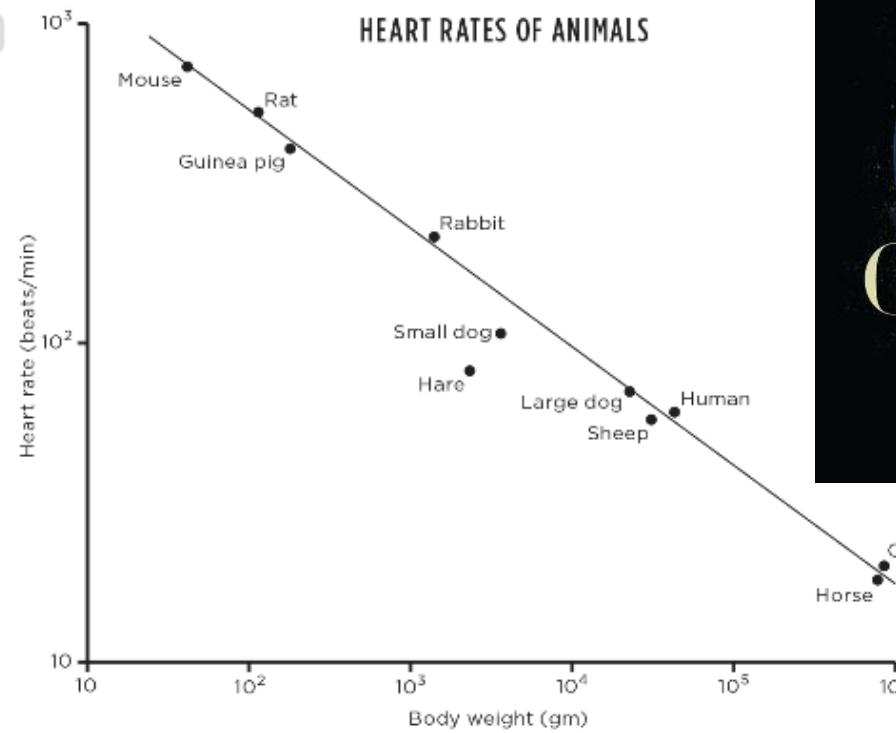


FIG. 11

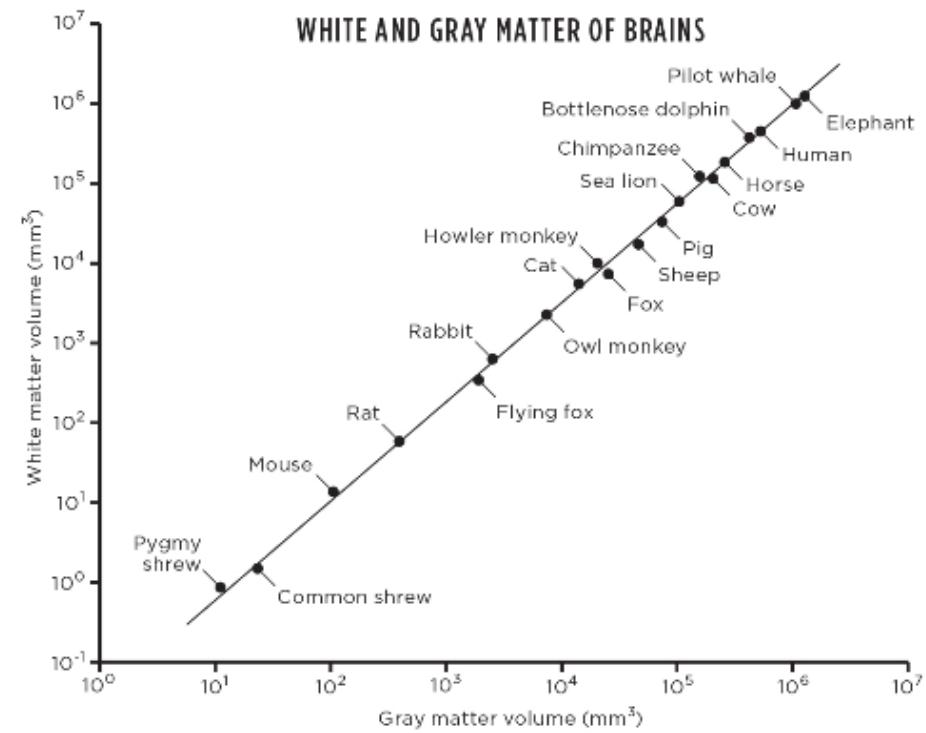


FIG. 2

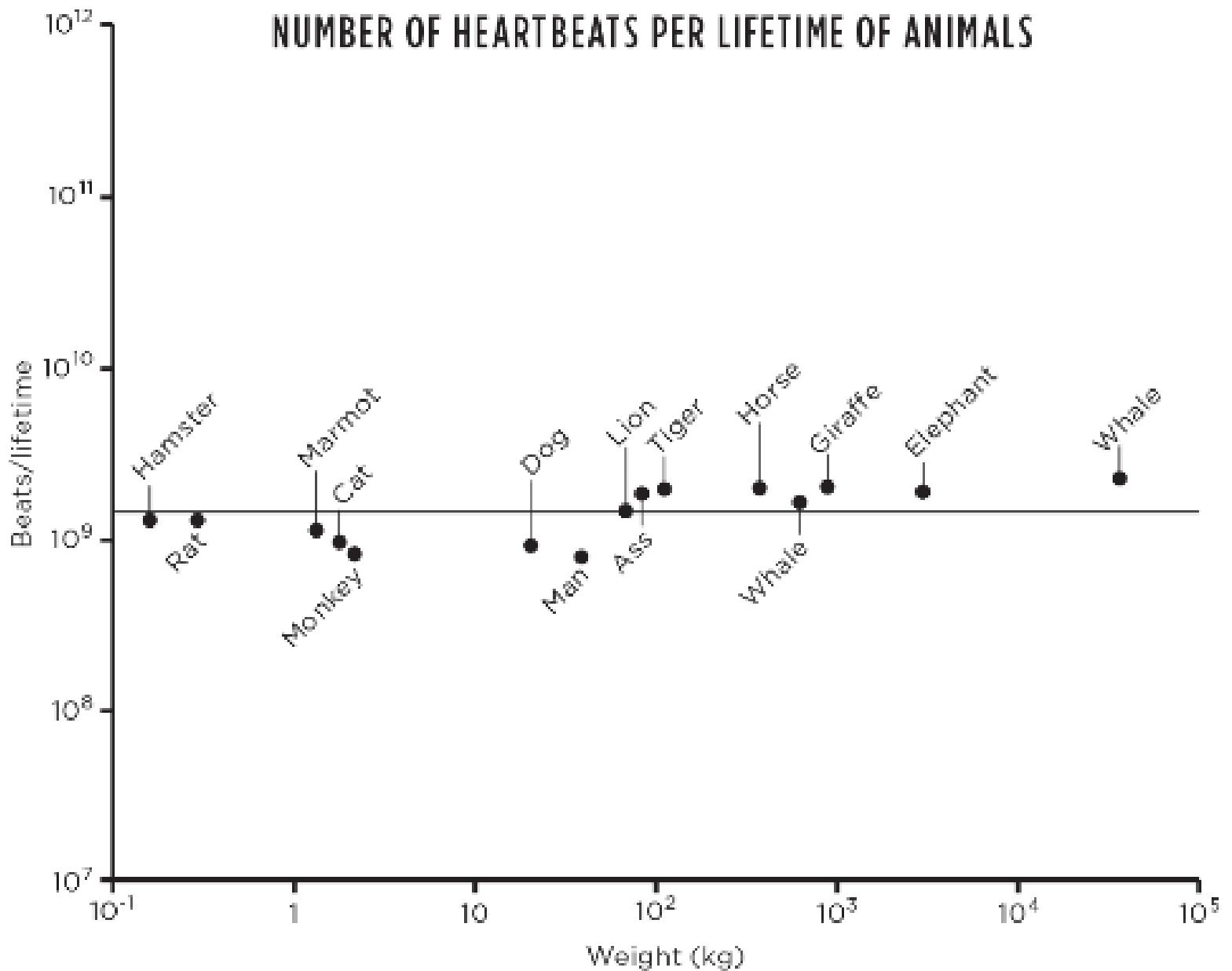


FIG. 3

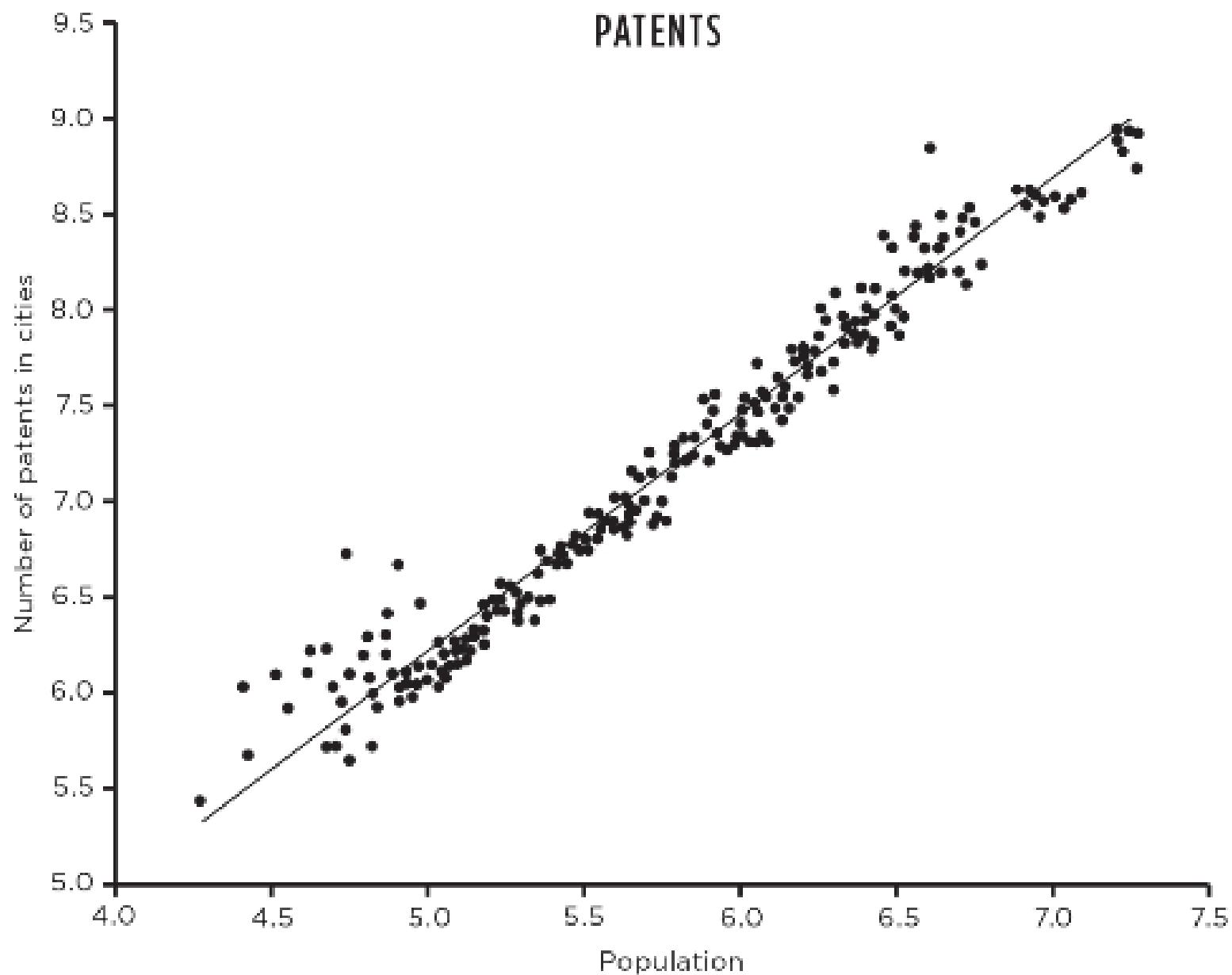


FIG. 4

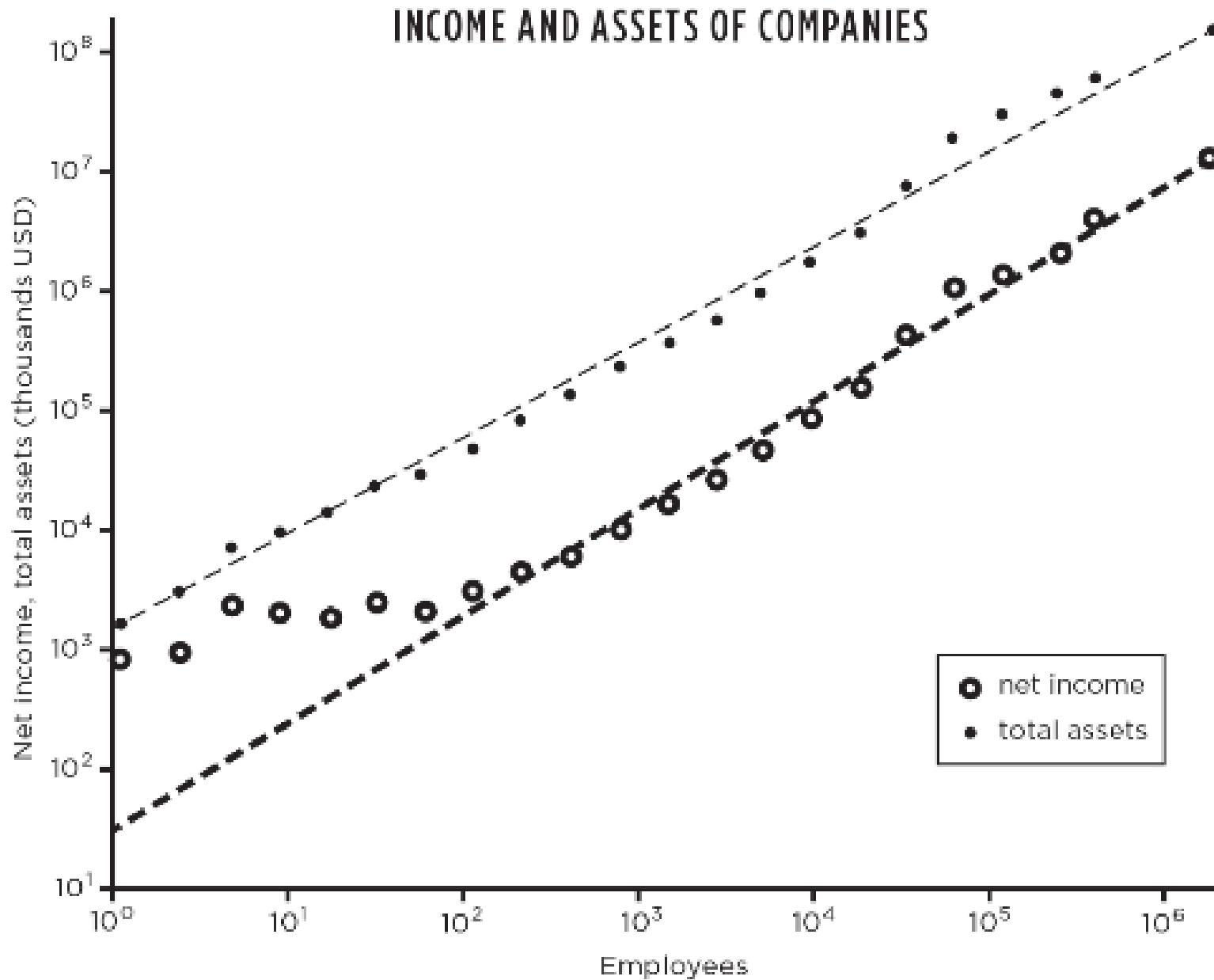
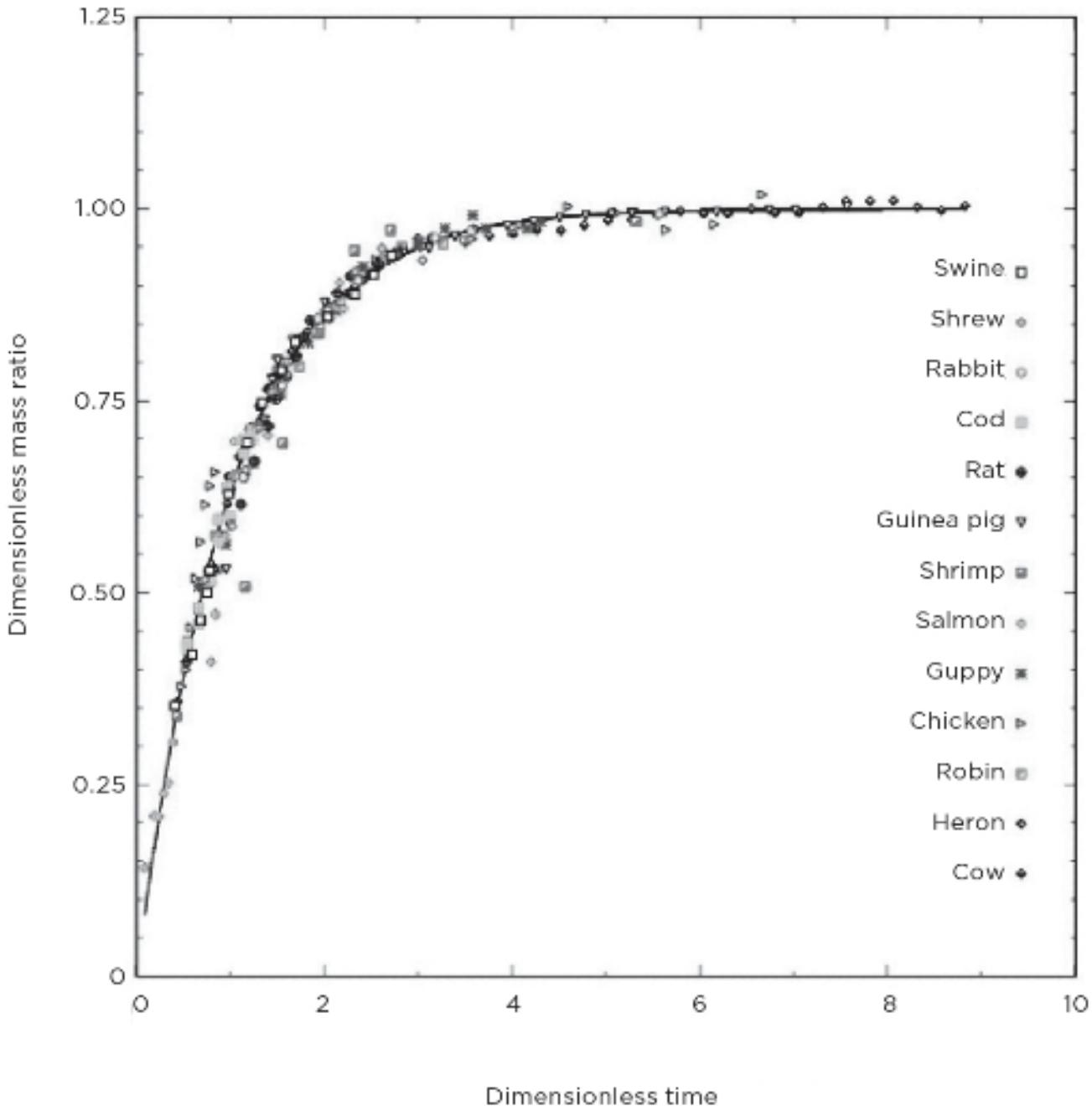


FIG. 19



The Seven Social Sins, as quoted
by Mahatma Gandhi in "Young India," 1925:

1. Politics without principles
2. Wealth without work
3. Pleasure without conscience
4. Knowledge without character
5. Commerce without morality
6. Science without humanity
7. Worship without sacrifice