

Social Physics and Complexity - SPAC

Física das Sociedades e
Complexidade

O uso do “big data” para perceber as interações humanas

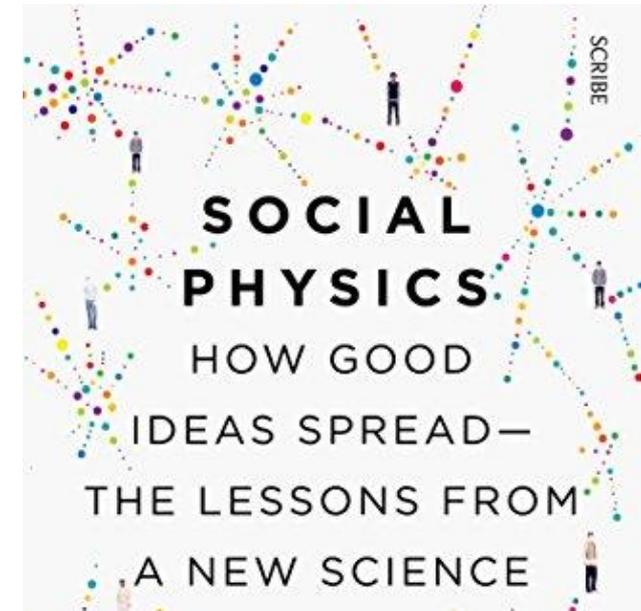


	QUESTIONS	DATA	TOOLS
HEALTH	 <p>Online vs. Offline Patterns Emergency Now-casting Antibiotic Over-prescription</p>	<p>Google Trends SNS24 Twitter ER acceptance /times SPMS e-prescriptions</p>	<p>Math Modelling ML Epidemiology</p>
POLICY	 <p>Political Decisions Gender Differences Agenda Setting Voting vs. Discourse</p>	<p>Media records Twitter Facebook Parliament data</p>	<p>NLP Networks Math Modelling Complex Systems</p>
BEHAVIOUR	 <p>Cognitive Biases Attitudes Towards Science Tracking Anxiety</p>	<p>Large scale surveys Behavioral experiments Twitter Facebook</p>	<p>Networks Math Modelling Psychology Information</p>

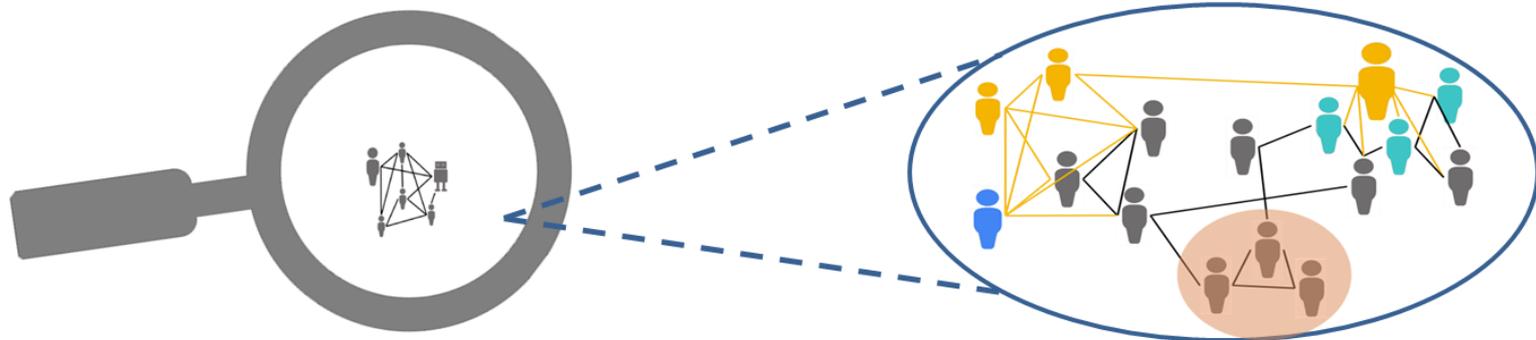
These problems—and a wide range of similar problems in the biological, medical, psychological, economic, and political sciences—are just too complicated to yield to the old nineteenth-century techniques which were so dramatically successful on two-, three-, or four-variable problems of simplicity. These new problems, moreover, cannot be handled with the statistical techniques so effective in describing average behavior in problems of disorganized complexity.

These new problems, and the future of the world depends on many of them, requires science to make a third great advance, an advance that must be even greater than the nineteenth-century conquest of problems of simplicity or the twentieth-century victory over problems of disorganized complexity. Science must, over the next 50 years, learn to deal with these problems of organized complexity.

Warren Weaver, 1947



Alex Pentland, 2014



From the Industrial Revolution to the Digital Revolution



First

Water and steam power is used to create mechanical production facilities.



1800

1784: First mechanical loom



Second

Electricity lets us create a division of labor and mass production.



1900

1870: First assembly line

Third

IT systems automate production lines further.



2000

1969: First programmable logic controller

Fourth

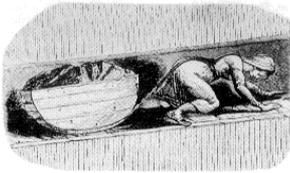
IoT and cloud technology automate complex tasks.



Today

Source: <https://mjolner.dk/2015/01/14/realizing-the-fourth-industrial-revolution/>

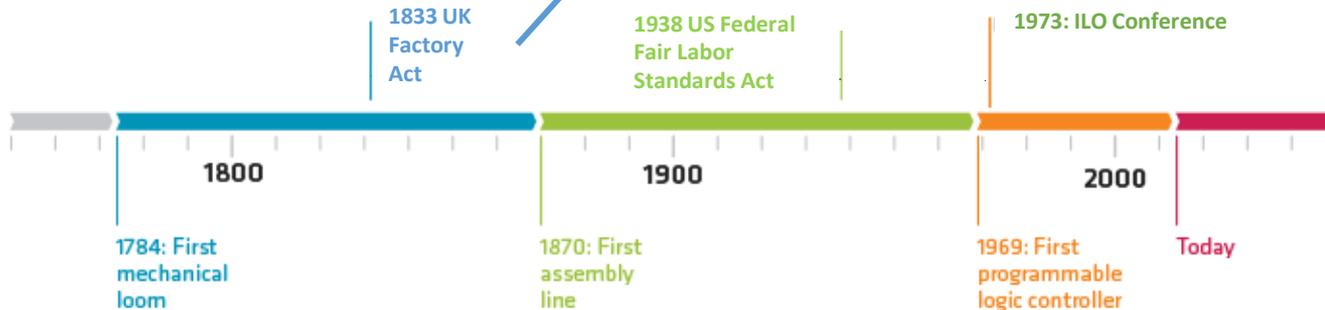
From the Industrial Revolution to the Digital Revolution



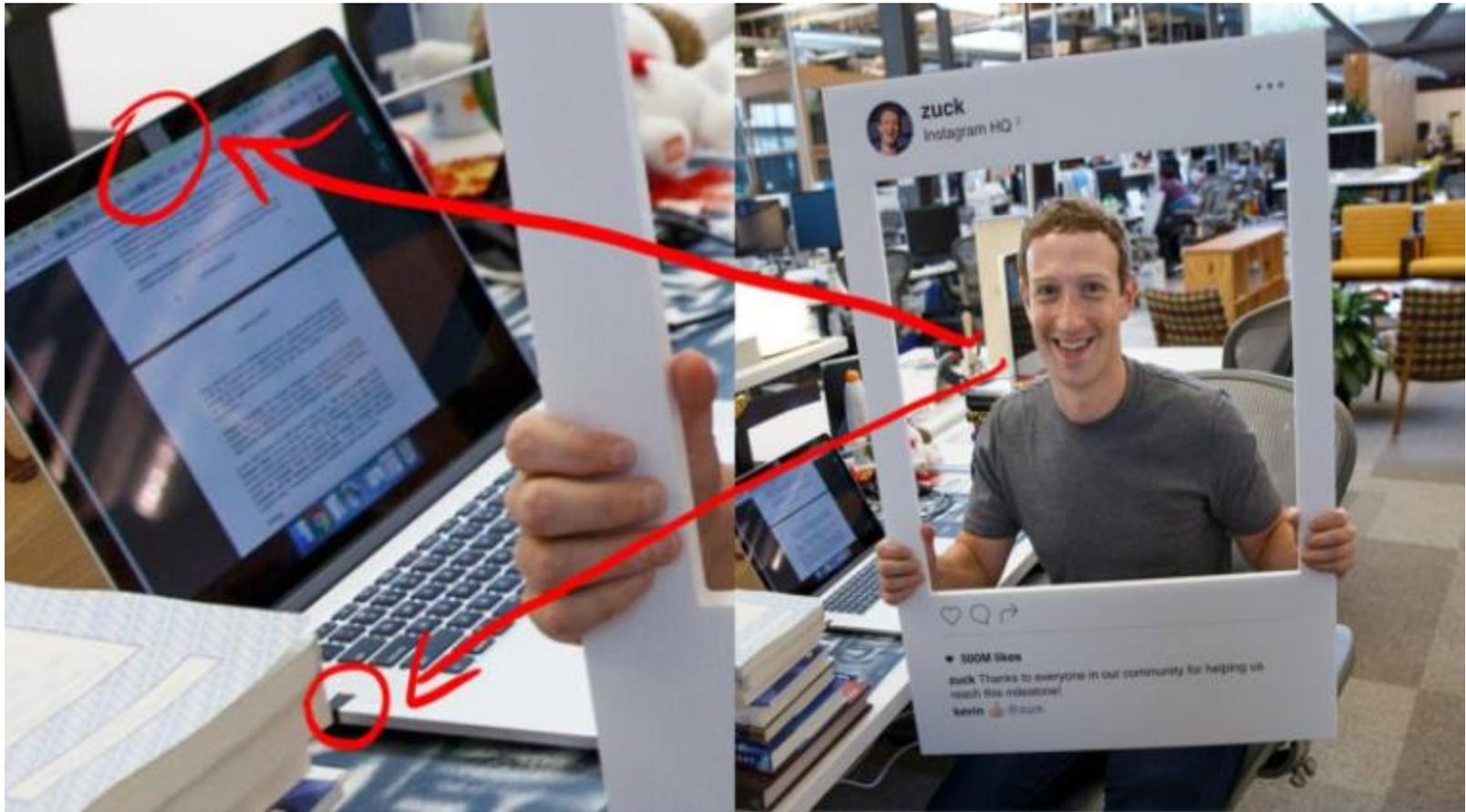
Child Labor in the Industrial Revolution



- 9 year old limit
- 9-13 yo should not work > 9h a day
- 13-18yo should not work > 12h a day
- Four inspectors



Source: <https://mjolner.dk/2015/01/14/realizing-the-fourth-industrial-revolution/>

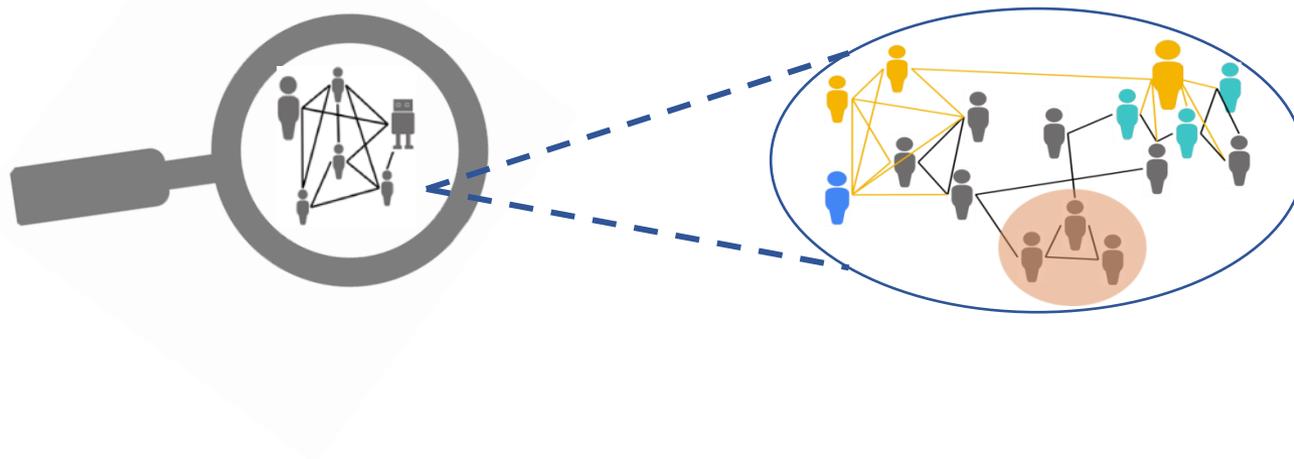


e só vai ler isso aqui por último

**VOCÊ VAI LER ISSO
AQUI PRIMEIRO**

depois vai ler isso aqui

e depois isso aqui



Criámos um “**macroscópio**”, mas temos de aprender a usá-lo

why am i so

why am i so **tired**
why am i so **ugly**
why am i so **gassy**
why am i so **thirsty**
why am i so **angry**
why am i so **itchy**
why am i so **sad**
why am i so **hungry**
why am i so **emotional**
why am i so **bloated**

como posso ser |

como posso ser **amigo de alguem**
como posso ser **feliz**
como posso ser **inteligente**
como posso ser **uma pessoa melhor**
como posso ser **salvo**
como posso ser **rico**
como posso ser **feliz sozinho**
como posso ser **um hacker**
como posso ser **popular no facebook**
como posso ser **cantora**

pourquoi je suis

pourquoi je suis **moche**
pourquoi je suis **triste**
pourquoi je suis **toujours fatigué**
pourquoi je suis **célibataire**
pourquoi je suis **toujours célibataire**
pourquoi je suis **devenu rebelle pdf**
pourquoi je suis **seule**
pourquoi je suis **toujours fatiguée**
pourquoi je suis **jalouse**
pourquoi je suis **triste sans raison**

how to

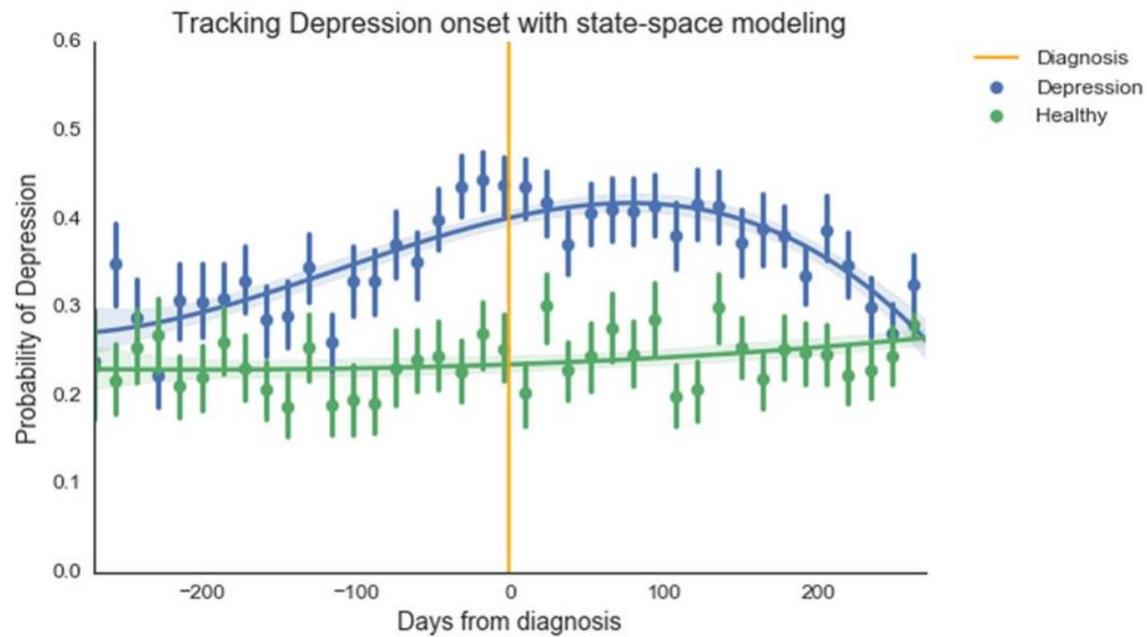
how to **make slime**
how to **tie a tie**
how to **buy bitcoin**
how to **lose weight**
how to **draw**
how to **buy ripple**
how to **kiss**
how to **make pancakes**
how to **mine bitcoin**
how to **train your dragon**

como é que se

como é que se **beija**
como é que se **diz eu te amo**
como é que se **beija de lingua**
como é que se **engravidar**
como é que se **beija na boca**
como é que se **escreve**
como é que se **beija pela primeira vez**
como é que se **faz um facebook**
como é que se **faz um relatório**
como é que se **faz panquecas**

comment faire

comment faire **du slime**
comment faire **un cv**
comment faire **des crepes**
comment faire **une dissertation**
comment faire **une capture d'écran**
comment faire **une bibliographie**
comment faire **un gateau**
comment faire **du caramel**
comment faire **de la glue**
comment faire **du pain**

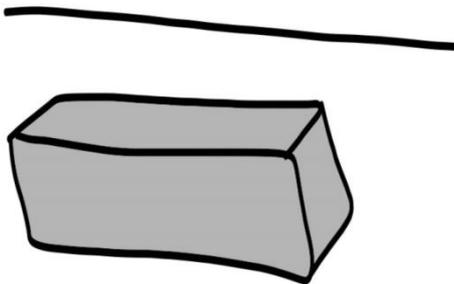
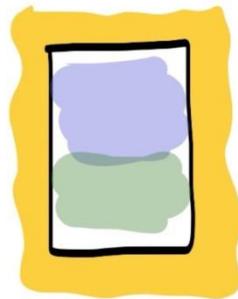


<https://www.nature.com/articles/s41598-017-12961-9>

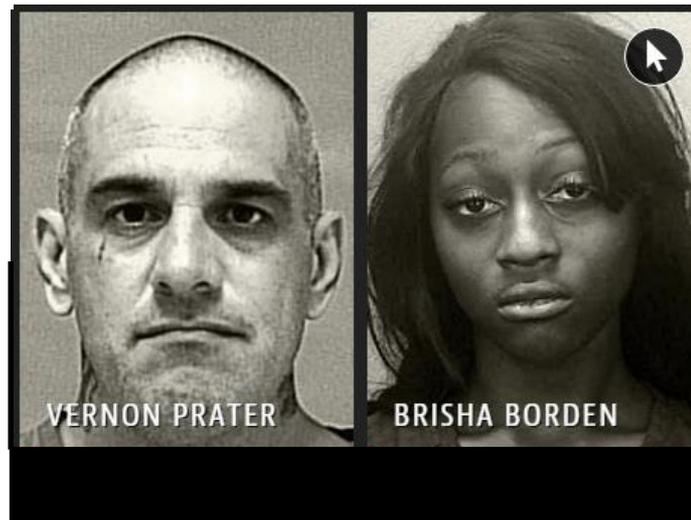
WILL Iot HELP US BECOME HAPPIER?

What if a picture knew it was making you feel calmer, more mindful...just happier?

Using sensors, apps & museums to enable wellbeing



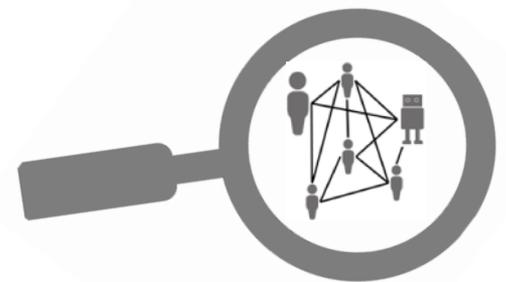
Punitive!



<https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing>

In summary

- O comportamento humano é um problema complexo
- Temos cada vez mais dados para perceber essa complexidade
- Os dados refletem os nossos enviesamentos
- Temos de saber lidar com esses enviesamentos

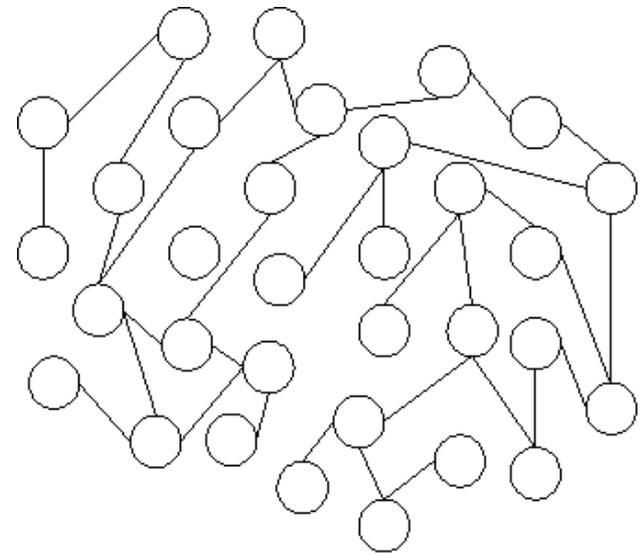


Example: Como é que a informação se espalha numa rede social

O Twitter como sistema modelo

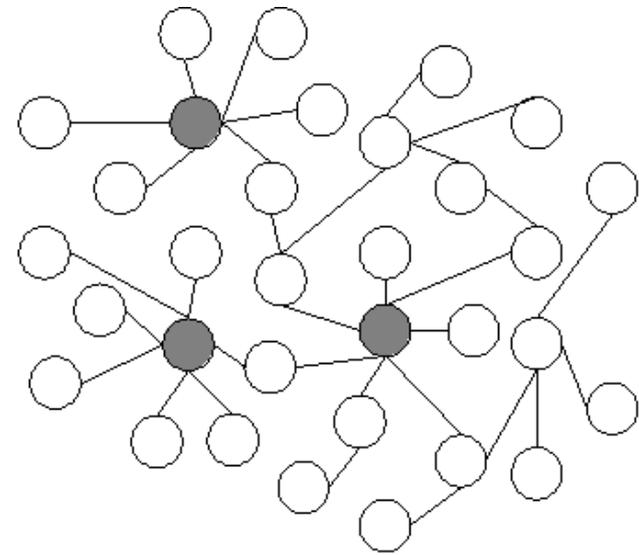
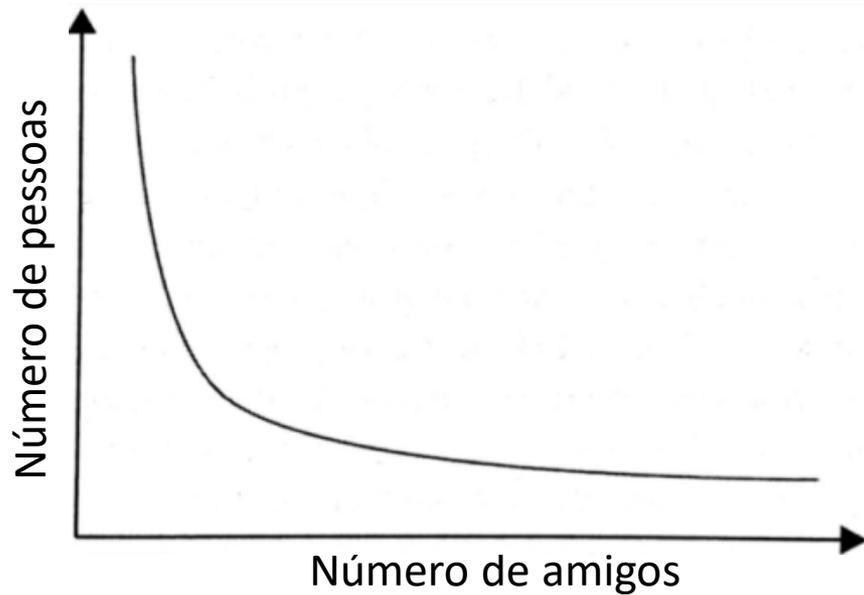


As redes sociais não seguem a distribuição normal



(a) Random network

As redes sociais não seguem a distribuição normal



(b) Scale-free network

- **Paradoxo da amizade:** Em média os nossos amigos têm mais amigos que nós

Paradoxo da amizade

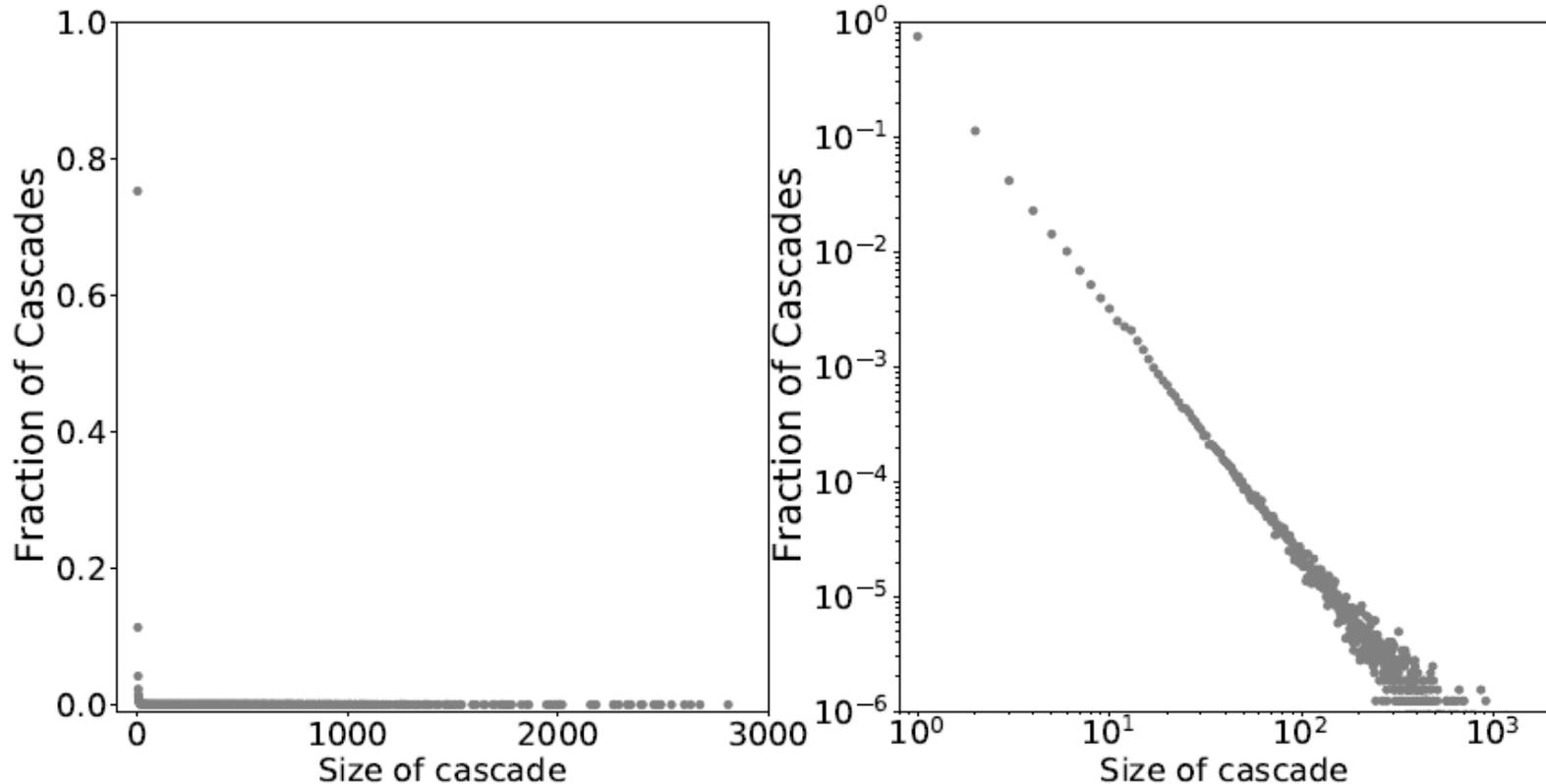
- Em média os nossos amigos são mais:
 - Populares
 - Ricos
 - Bonitos
 - ...



Definições importantes

- **Cascata de Tweets:** Todas as cópias de um tweet inicial
- **Fitness:** Taxa de cópia de um tweet

O tamanho das cascata de tweets também é powerlaw





“Todos os modelos estão errados,
mas alguns são úteis”

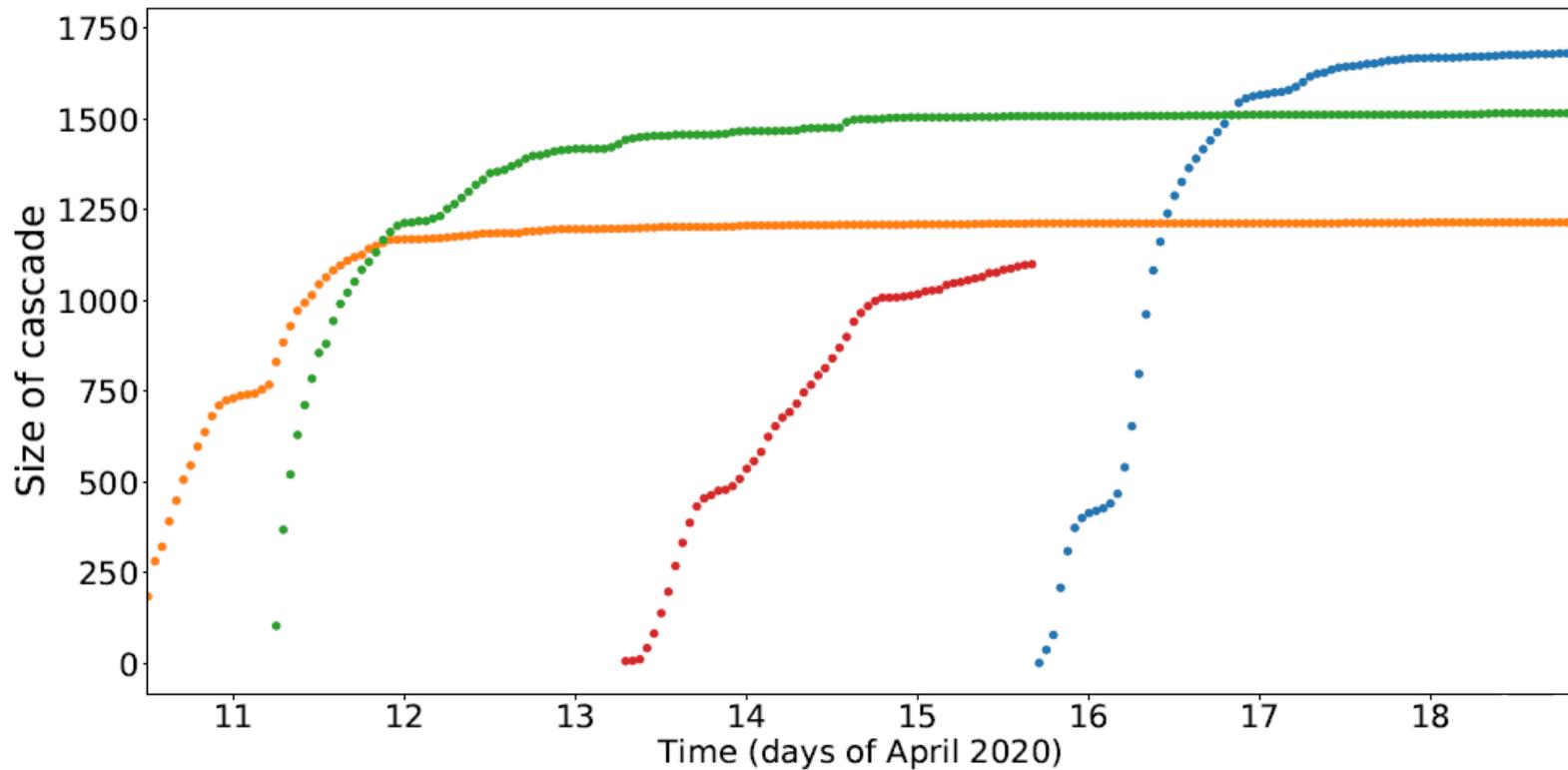


“Não vamos assumir pluralidade
quando não é necessário” – a navalha
de Occam

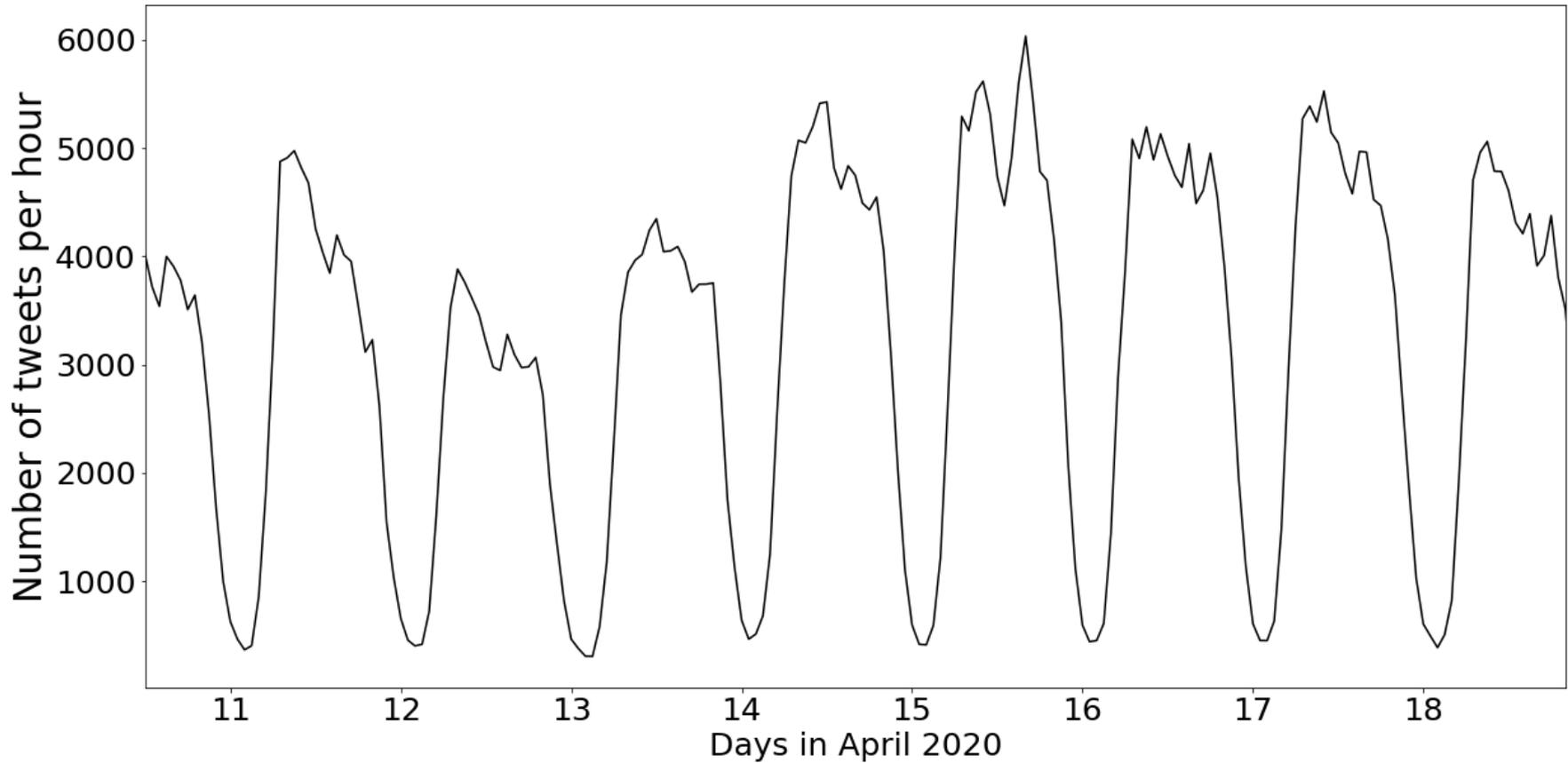


“Devemos tornar tudo o mais simpels
possível, mas não mais que isso”

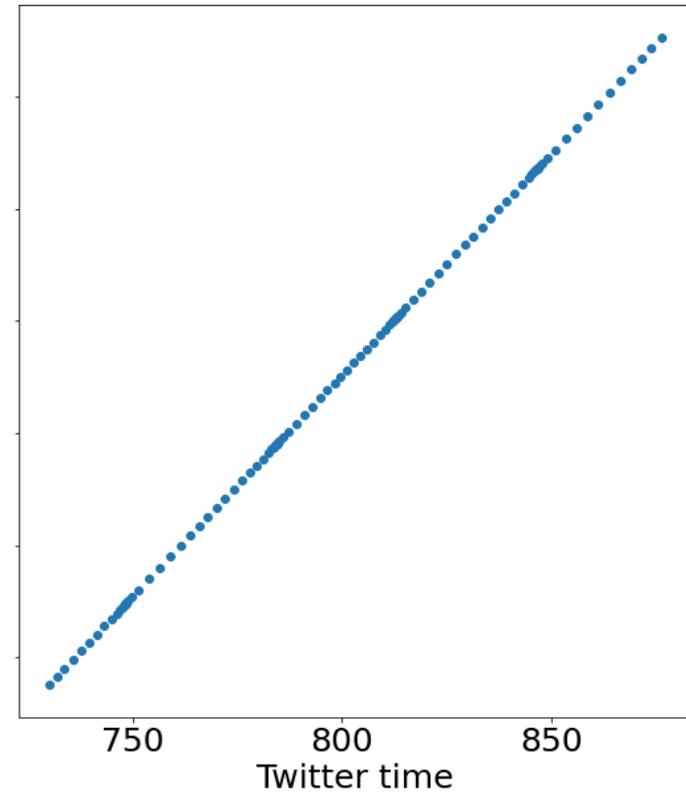
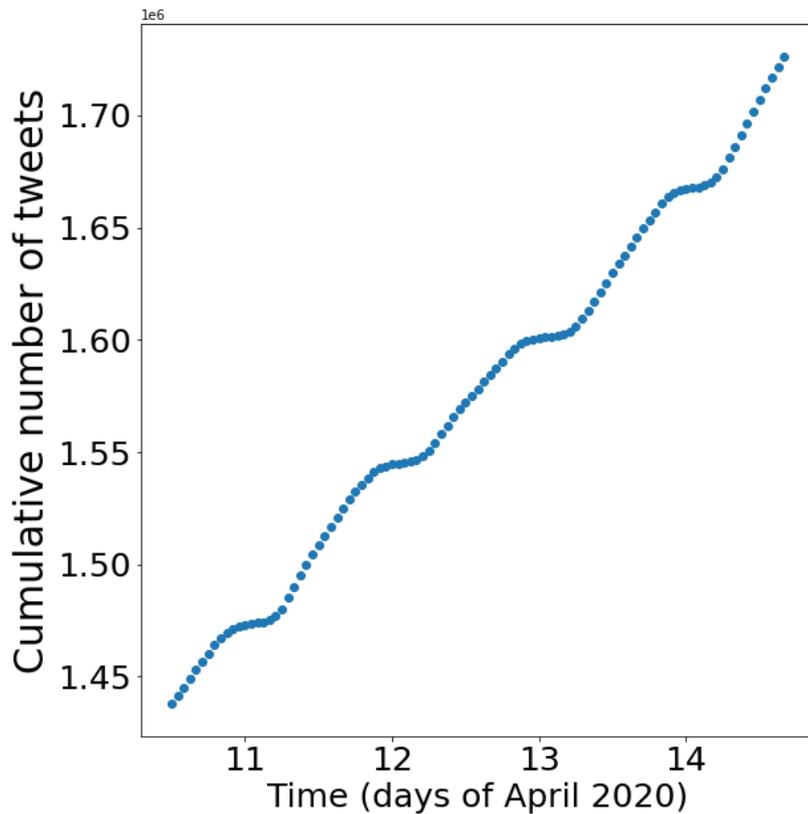
Crescimento das cascatas



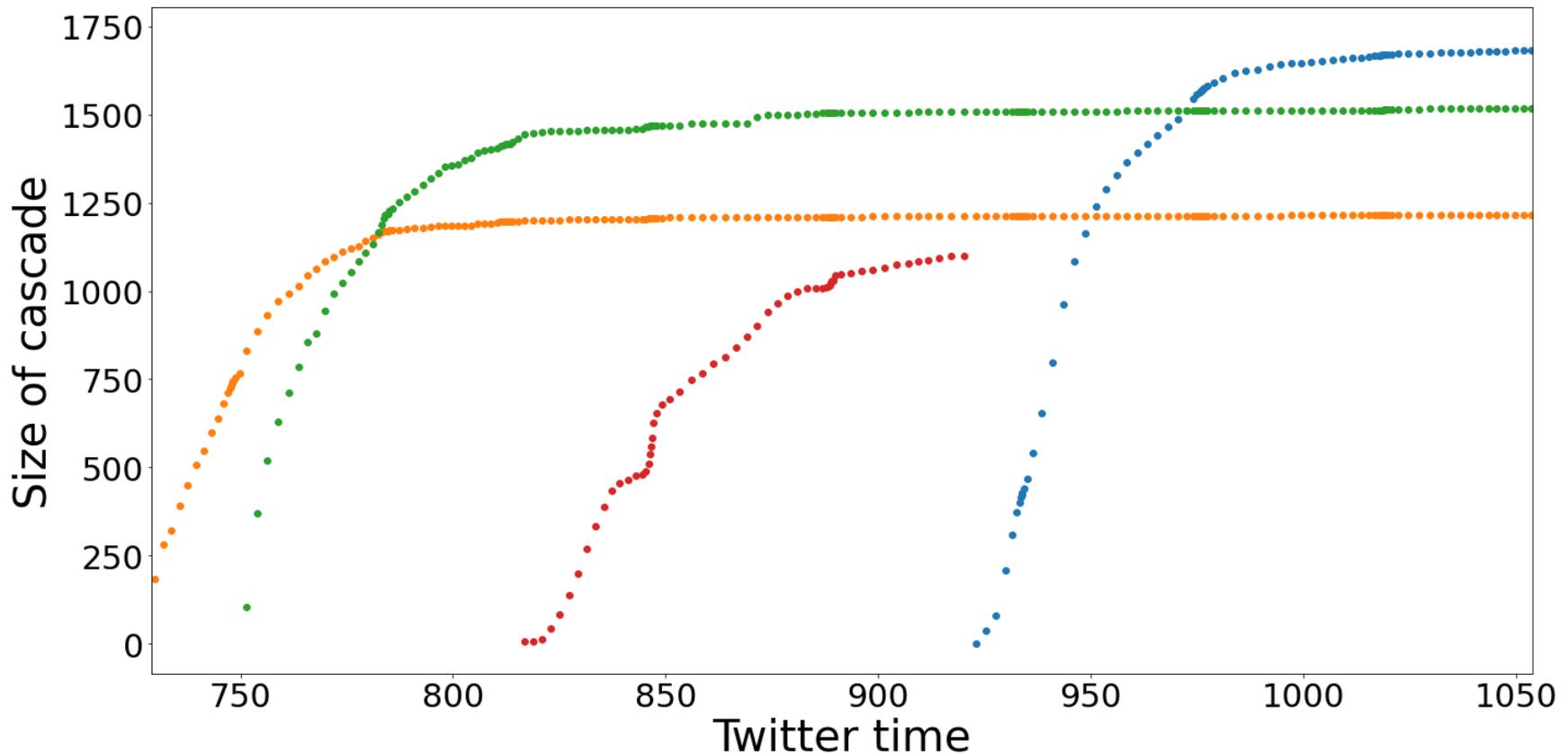
Introducing Twitter time



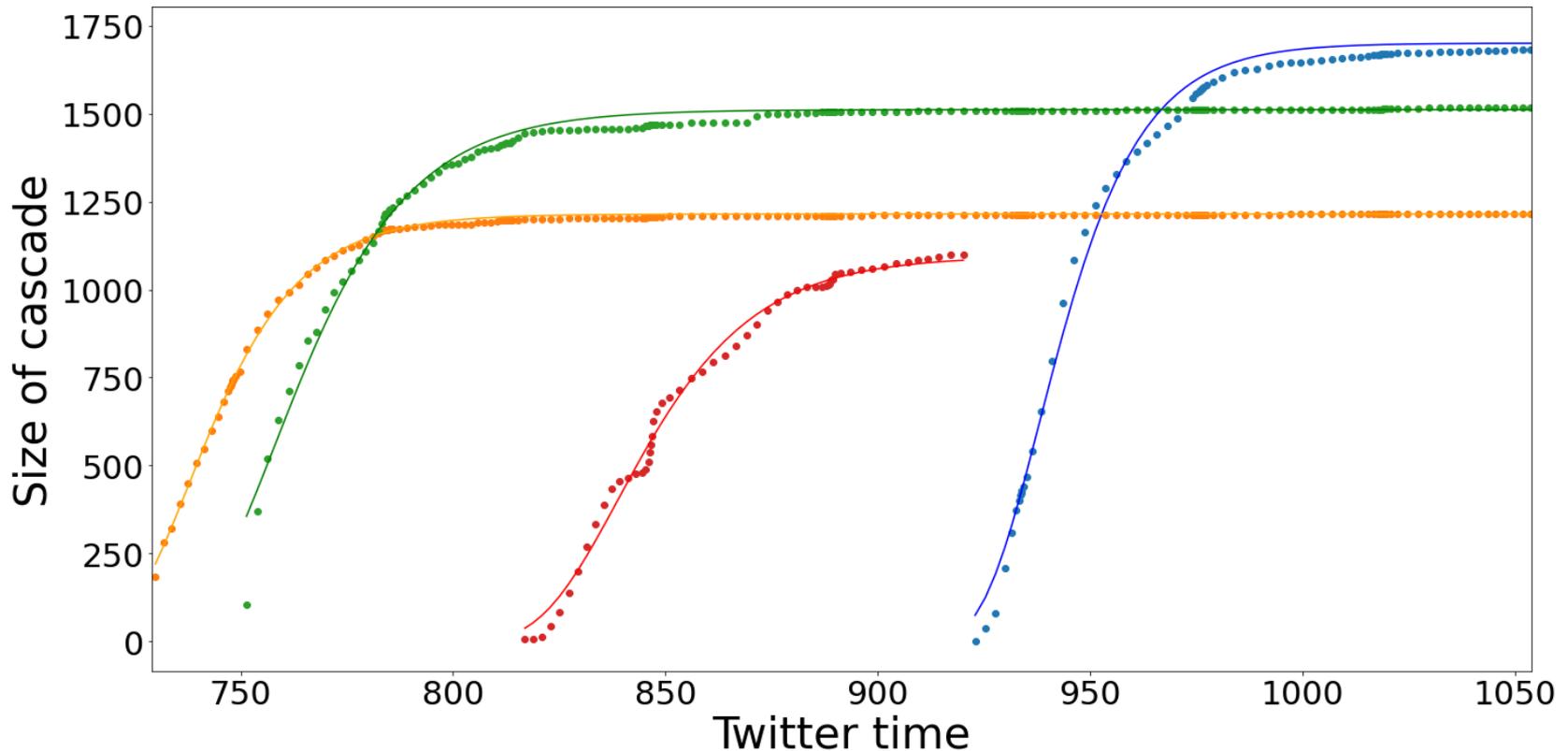
Também no Twitter o tempo é relativo



The simplest model for cascade growth

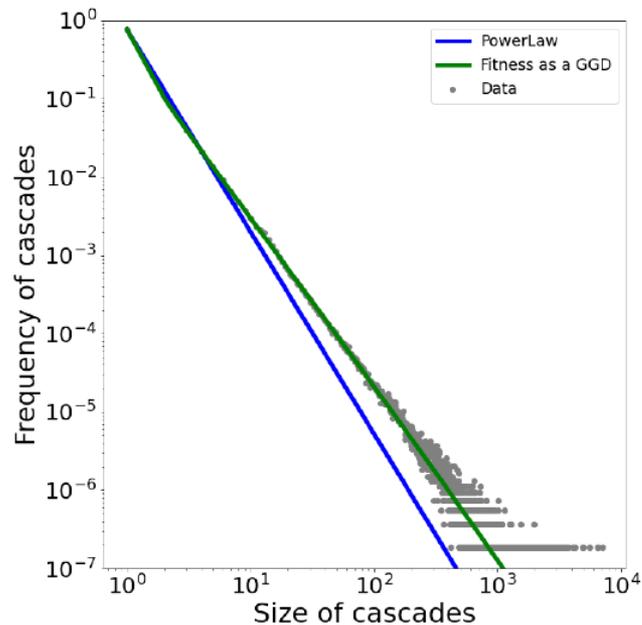


The simplest model for cascade growth



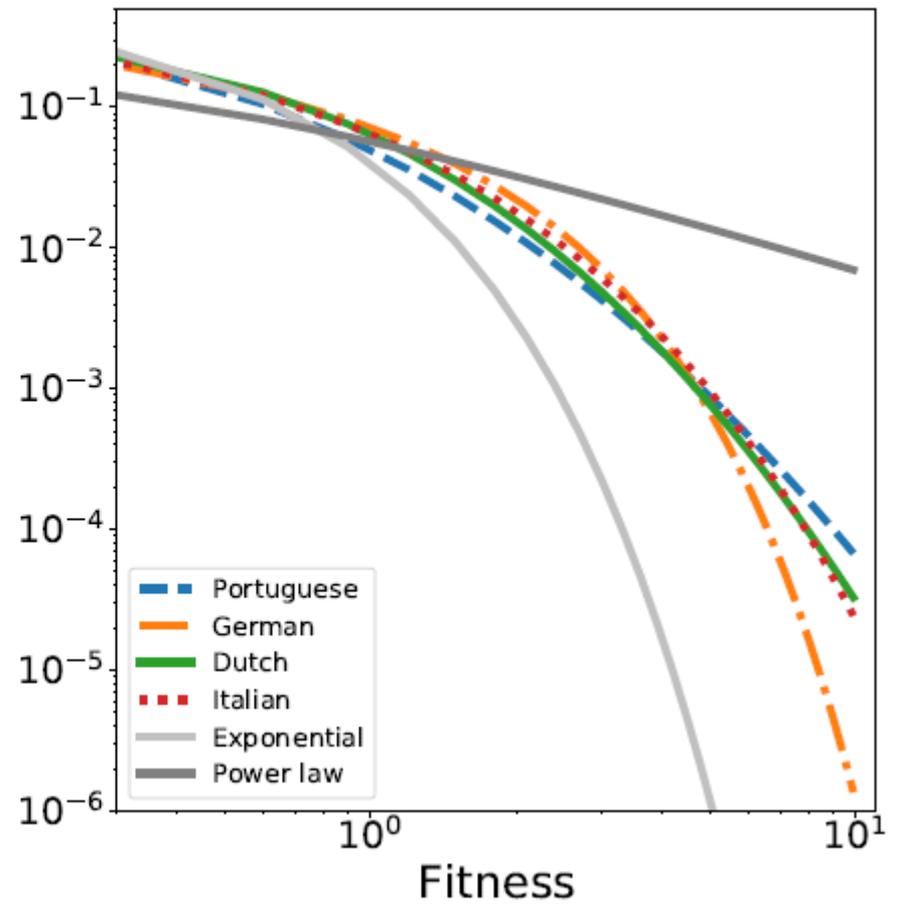
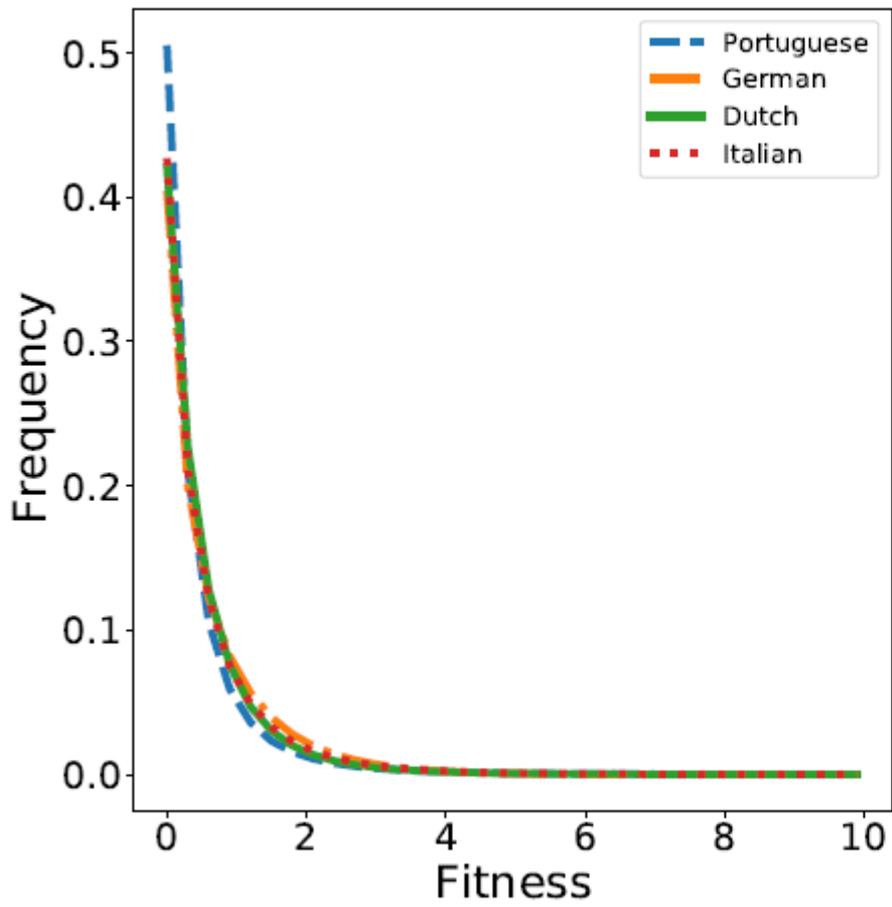
$$N(t) = N(0) \cdot e^{\frac{a}{g}} e^{a \cdot e^{-g \cdot t}}$$

FITTING THE GENERALIZED GAMMA DISTRIBUTION (GGD) TO FITNESS



$$f(x, a, c, \theta) = \frac{|c| \cdot x^{c \cdot a - 1} \cdot e^{-\frac{x^c}{\theta}}}{\theta^{c \cdot a} \cdot \Gamma(a)}$$

	a	c	top 20%
Portuguese	60	0.11	0.31
German	0.27	1.3	0.46
Dutch	65	0.14	0.36
Italian	1.0	0.69	0.36



FARE - Fake News and Real People - Using Big Data to Understand Human Behaviour

<https://cordis.europa.eu/project/id/853566>

<https://tinyurl.com/SPAComplexity>



European Research Council

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