$$8 + 8 + 8 = 24$$

$$(4 + 4 - 4)! = 24$$

$$\left(\log_{\sqrt{|\alpha|}}(|\alpha| \times |\alpha|)\right)! = 24 \qquad |\alpha| \neq 0, 1$$

$$8 + 8 + 8 = 24$$

$$(4 + 4 - 4)! = 24$$

$$\left(\log_{\sqrt{|\alpha|}}(|\alpha| \times |\alpha|)\right)! = 24 \qquad |\alpha| \neq 0, 1$$

$$\begin{aligned} &(1 + 1 + 1)! \\ + \quad &\text{—"—} \quad = 24 \qquad (0! = 1) \\ + \quad &\text{—"—} \\ + \quad &\text{—"—} \end{aligned}$$

$(4$

$\left(\log_{\sqrt{|\alpha|}}((|\alpha$

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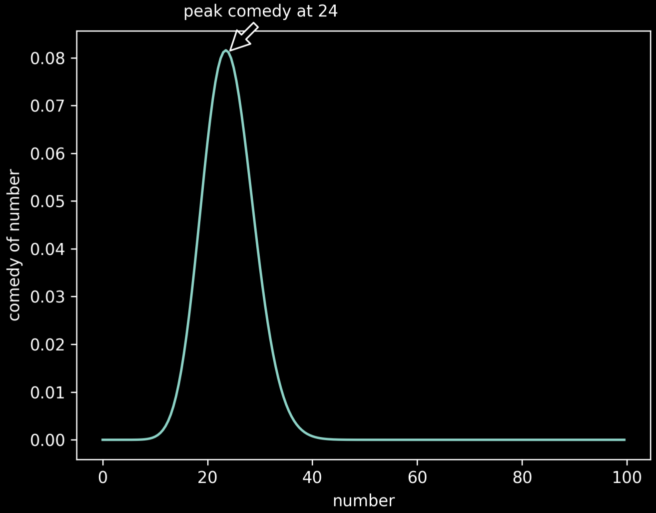

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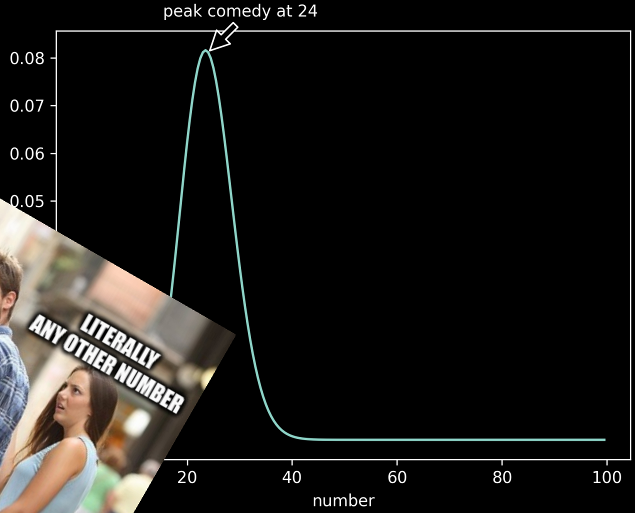
peak comedy at 24
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number


24
LITERALLY ANY OTHER NUMBER
imgflip.com

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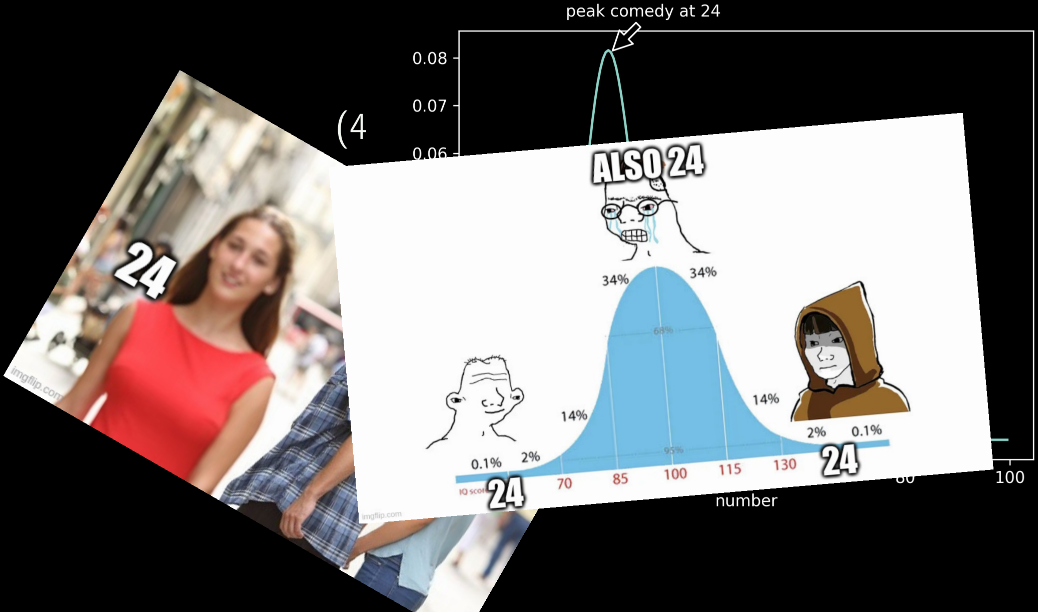

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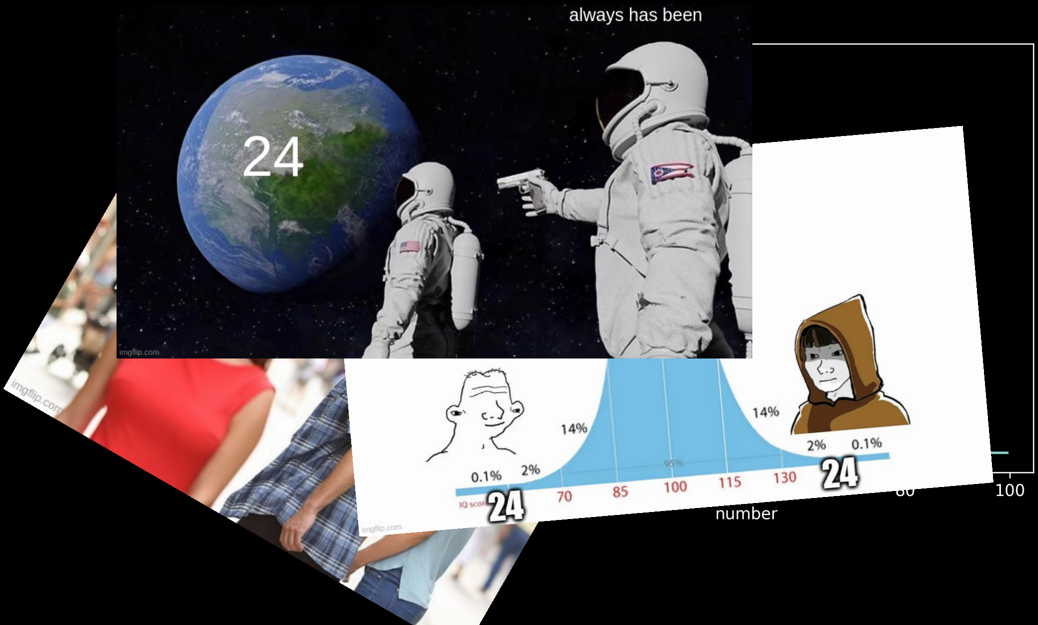
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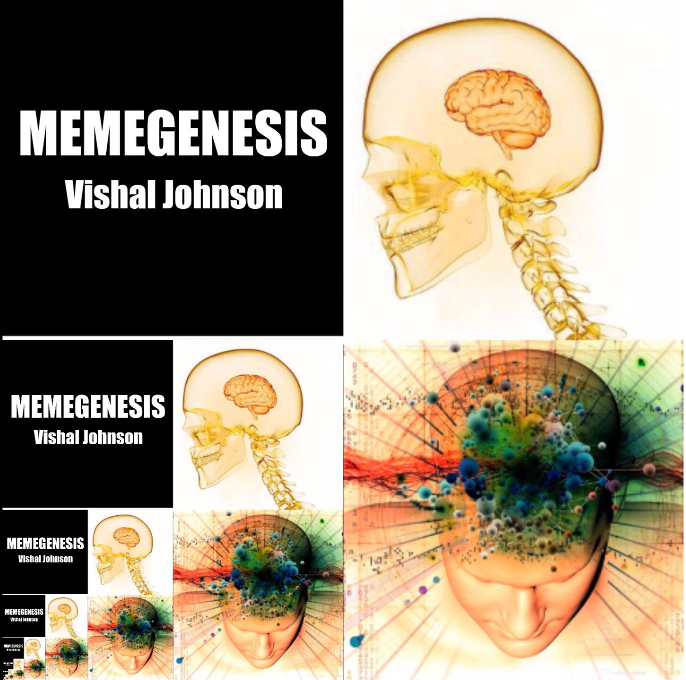

IFT@Schneefernerhaus 25

November 26, 2025

What is a meme?

What is a meme?

meme: self replicating entity

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gene: unit of heredity

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- more copies of memes/genes $\rightarrow$ further copies

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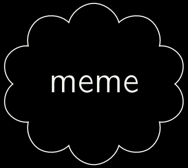
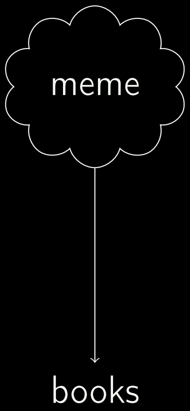
- more copies of memes/genes $\rightarrow$ further copies
- have a physical basis
- meme gene sisters! (sorry)

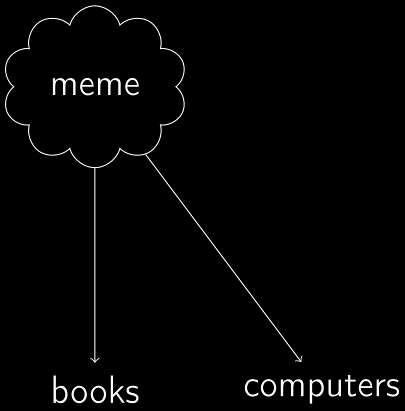
Physical basis



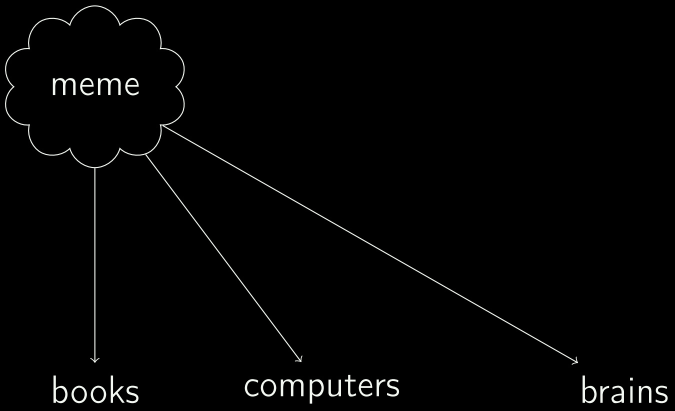
Physical basis



Physical basis



Physical basis



Meme dynamics hypothesis

Meme dynamics

$$dm \propto m \tag{1}$$

m : copies of memes

Meme dynamics

$$dm \propto m \left(1 - {}^{m}/_{N}\right) \tag{1}$$

m : copies of memes, N: carrying capacity

Meme dynamics

$$dm = m\left(1 - {}^{m}/_{N}\right)\left(\alpha\, dt + \sigma\, dW\right) \tag{1}$$

m : copies of memes, N: carrying capacity, α : deterministic growth rate, σ : stochastic growth rate, dW : Wiener process

Meme dynamics

$$dm_i = m_i \left(1 - \sum {}^{m_k}\!/_{N}\right) \left(\alpha_i dt + \sigma_i dW_i\right) \tag{1}$$

m_i: copies of memes, N: carrying capacity, α_i: deterministic growth rate, σ_i: stochastic growth rate, dW_i: Wiener process

Meme dynamics

$$
\begin{aligned}
dm_i = m_i \left(1 - \textstyle\sum {}^{m_k}\!/_{N}\right) \left(\alpha_i dt + \sigma_i dW_i\right) \\
+ \left(1 - \textstyle\sum {}^{m_k}\!/_{N}\right) R_i \sigma_i dW_i
\end{aligned} \tag{1}
$$

m_i: copies of memes, N: carrying capacity, α_i: deterministic growth rate, σ_i: stochastic growth rate, dW_i: Wiener process, R_i: amemegenesis rate

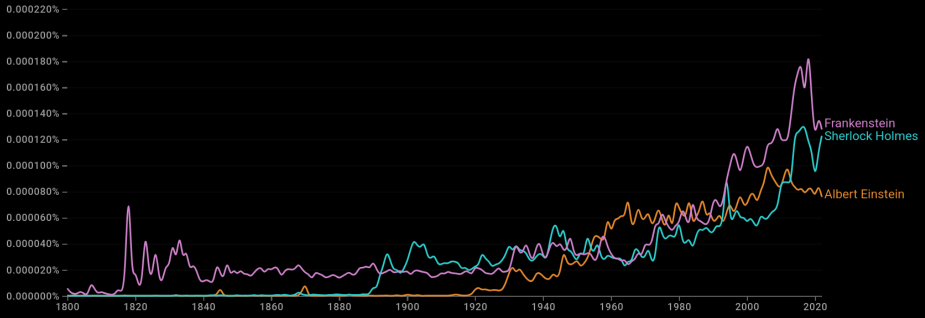
Meme dynamics

$$
\begin{aligned}
dm_i &= m_i \left(1 - \sum {}^{m_k}\!/\!{}_N\right) \left(\alpha_i dt + \sigma_i dW_i\right) \\
&\qquad\qquad + \left(1 - \sum {}^{m_k}\!/\!{}_N\right) R_i \sigma_i dW_i \\
&= \underbrace{A_i(\{m\}, t)}_{\alpha_i m_i (1 - \sum {}^{m_k}/{}_N)} \; dt + \underbrace{B_i(\{m\}, t)}_{\sigma_i (m_i + R_i)(1 - \sum {}^{m_k}/{}_N)} \; dW_i
\end{aligned} \tag{1}
$$

m_i: copies of memes, N: carrying capacity, α_i: deterministic growth rate, σ_i: stochastic growth rate, dW_i: Wiener process, R_i: amemegenesis rate

Data?

Google ngram



Credit: *books.google.com/ngrams*

Figure 1: Google ngram view of the memes "Albert Einstein", "Frankenstein", and "Sherlock Holmes" [Mic+11].

Mean field dynamics

Mean field — A linear

Mean field — A linear

$$A_i(\{m\},t)dt + A_j(\{m\},t)dt = \alpha m_i(1 - \sum {}^{m_k}/_N)dt + \alpha m_j(1 - \sum {}^{m_k}/_N)dt \quad (2)$$

Mean field — A linear

$$
\begin{aligned}
A_i(\{m\},t)dt + A_j(\{m\},t)dt &= \alpha m_i(1-\textstyle\sum m_k/N)dt + \alpha m_j(1-\textstyle\sum m_k/N)dt \\
&= \alpha(m_i+m_j)(1-\textstyle\sum m_k/N)dt \qquad (2)
\end{aligned}
$$

Mean field — A linear

$$\begin{aligned} A_i(\{m\},t)dt + A_j(\{m\},t)dt &= \alpha m_i(1 - \sum {}^{m_k}/_{N})dt + \alpha m_j(1 - \sum {}^{m_k}/_{N})dt \\ &= \alpha(m_i + m_j)(1 - \sum {}^{m_k}/_{N})dt \qquad (2) \\ &= A_{i\vee j}(\{m\},t)dt \end{aligned}$$

Mean field — B non-linear

Mean field — B non-linear

setting $R = 0$

$$
\begin{aligned}
B_i(\{m\}, t)dW_i + B_j(\{m\}, t)dW_j \\
&= \sigma\left(1 - \sum {m_k}/{N}\right)\left(m_i dW_i + m_j dW_j\right)
\end{aligned}
$$

Mean field — B non-linear

setting $R = 0$

$$\begin{aligned} B_i(\{m\},t)dW_i + B_j(\{m\},t)dW_j \\ &= \sigma\left(1 - \sum {}^{m_k}/_{N}\right)\left(m_i dW_i + m_j dW_j\right) \\ &= \sigma(m_i + m_j)\left(1 - \sum {}^{m_k}/_{N}\right)\left(f_i dW_i + f_j dW_j\right) \qquad (3) \\ &\quad \left(f_{\{i,j\}} = {}^{m_{\{i,j\}}}/_{m_i + m_j}\right) \end{aligned}$$

Mean field — B non-linear

setting $R = 0$

$$
\begin{aligned}
B_i(\{m\}, t)dW_i &+ B_j(\{m\}, t)dW_j \\
&= \sigma\left(1 - \textstyle\sum {}^{m_k}\!/_{N}\right)\left(m_i dW_i + m_j dW_j\right) \\
&= \sigma(m_i + m_j)\left(1 - \textstyle\sum {}^{m_k}\!/_{N}\right)\left(f_i dW_i + f_j dW_j\right) \qquad (3) \\
&\qquad \left(f_{\{i,j\}} = {}^{m_{\{i,j\}}}\!/_{m_i + m_j}\right) \\
&= B_{i\vee j}(\{m\}, t)\sqrt{f_i^2 + f_j^2}\, dW_{i\vee j}
\end{aligned}
$$

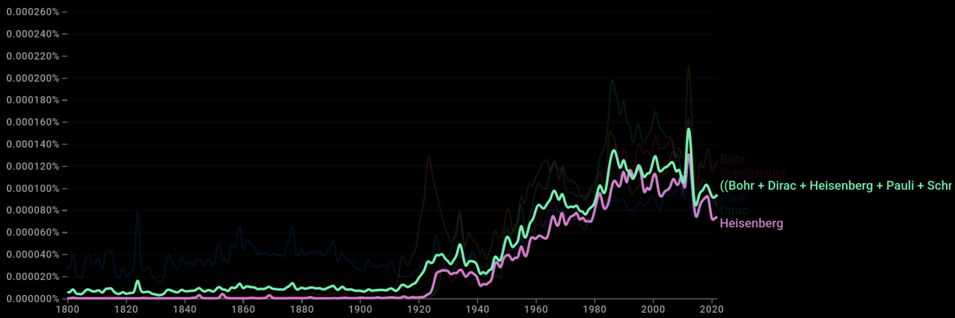
Mean field — B non-linear

setting $R = 0$

$$
\begin{aligned}
B_i(\{m\}, t)dW_i + B_j(\{m\}, t)dW_j \\
&= \sigma\left(1 - \textstyle\sum {}^{m_k}/_{N}\right)\left(m_i dW_i + m_j dW_j\right) \\
&= \sigma(m_i + m_j)\left(1 - \textstyle\sum {}^{m_k}/_{N}\right)\left(f_i dW_i + f_j dW_j\right) \qquad (3) \\
&\qquad \left(f_{\{i,j\}} = {}^{m_{\{i,j\}}}/_{m_i + m_j}\right) \\
&= B_{i \vee j}(\{m\}, t)\sqrt{f_i^2 + f_j^2}\, dW_{i \vee j}
\end{aligned}
$$

$$
\sqrt{\sum_i^M f_i^2} \approx \sqrt{\frac{1}{M}} \qquad (4)
$$

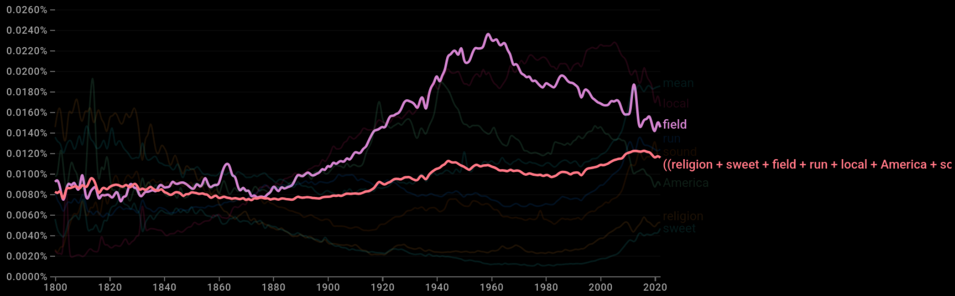
Mean field — correlated memes



Credit: *books.google.com/ngrams*

Figure 2: Google ngram view of several memes and their average — visible memes are "Heisenberg" (purple) and "(Bohr+Dirac+Heisenberg+Pauli+Schrödinger)/5" (green). Due to correlations between them, the stochasticity does **not** reduce.

Mean field — uncorrelated memes



Credit: *books.google.com/ngrams*

Figure 3: Google ngram view of several memes and their average — visible memes are "field" (purple) and "(religion+sweet+field+run+local+America+sound+mean)/8" (red). Due to their uncorrelated nature, the stochasticity of the average is lower.

Mean field — dynamics

$$
\begin{aligned}
dm_{\text{eme}} &= \left(1 - \frac{m_{\text{eme}} + m_{\text{rest}}}{N}\right)\left(m_{\text{eme}}\alpha dt + \sigma_{\text{eme}}(m_{\text{eme}} + R)dW_{\text{eme}}\right) \\
dm_{\text{rest}} &= \left(1 - \frac{m_{\text{eme}} + m_{\text{rest}}}{N}\right)\left(m_{\text{rest}}\alpha dt + \sigma_{\text{rest}}(m_{\text{rest}} + R)dW_{\text{rest}}\right)
\end{aligned} \tag{5}
$$

$m_{\text{rest}} >> \sqrt{M}R, \sigma_{\text{eme}} >>> \sigma_{\text{rest}}$

Mean field — dynamics

$$
\begin{aligned}
dm_{\text{eme}} &= \left(1 - \frac{m_{\text{eme}} + m_{\text{rest}}}{N}\right)(m_{\text{eme}}\alpha dt + \sigma_{\text{eme}}(m_{\text{eme}} + R)dW_{\text{eme}}) \\
dm_{\text{rest}} &= \left(1 - \frac{m_{\text{eme}} + m_{\text{rest}}}{N}\right) m_{\text{rest}}\alpha dt
\end{aligned}
\tag{5}
$$

$m_{\text{rest}} >> \sqrt{M}R, \sigma_{\text{eme}} >>> \sigma_{\text{rest}} = 0$

Mean field — dynamics

$$
\begin{aligned}
dm_{\text{eme}} &= \left(1 - \frac{m_{\text{eme}} + m_{\text{rest}}}{N}\right)(m_{\text{eme}}\alpha dt + \sigma_{\text{eme}}(m_{\text{eme}} + R)dW_{\text{eme}}) \\
dm_{\text{rest}} &= \left(1 - \frac{m_{\text{eme}} + m_{\text{rest}}}{N}\right) m_{\text{rest}}\alpha dt \\
dN &= \alpha_N N dt
\end{aligned} \tag{5}
$$

$m_{\text{rest}} >> \sqrt{M}R, \sigma_{\text{eme}} >>> \sigma_{\text{rest}} = 0$
α_N: exponential growth rate of carrying capacity [FJ15; BZ09]

Code demo

Demo

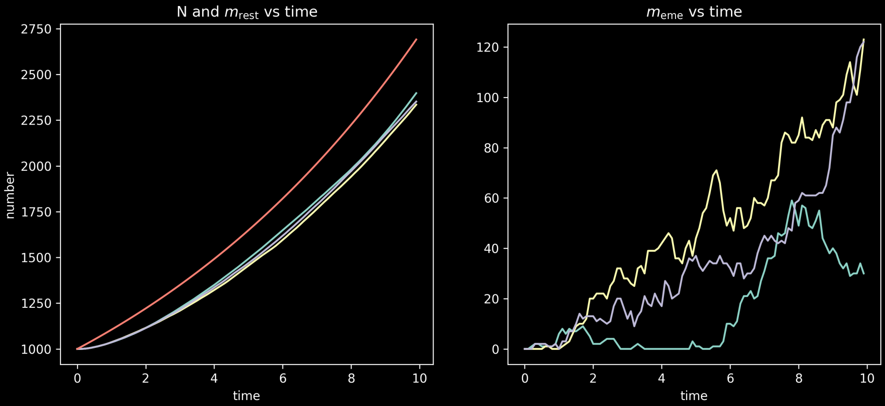


Figure 4: Plot on the left shows number vs time. Plot on the right shows the meme ratio vs time.

Demo

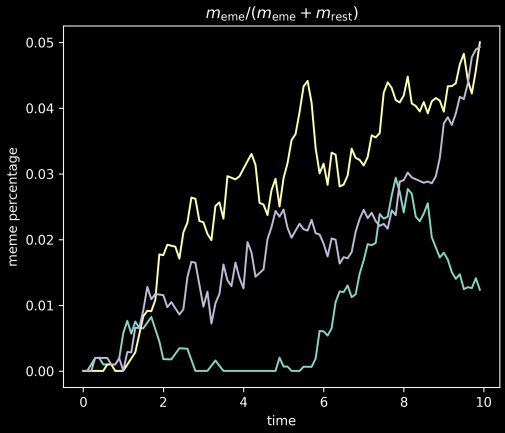


Figure 5: Ratio of $m_{\mathbf{eme}}/m_{\mathbf{eme}}+m_{\mathbf{rest}}$ over time.

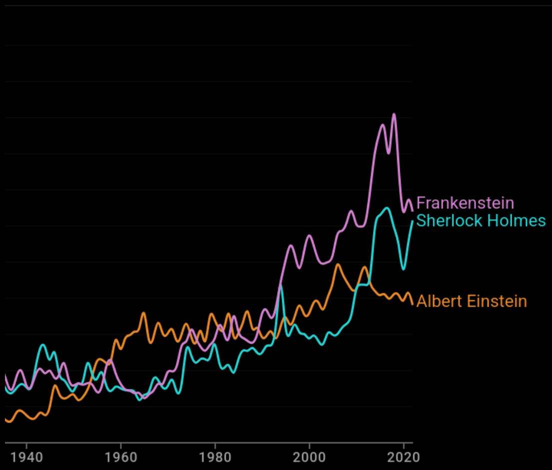
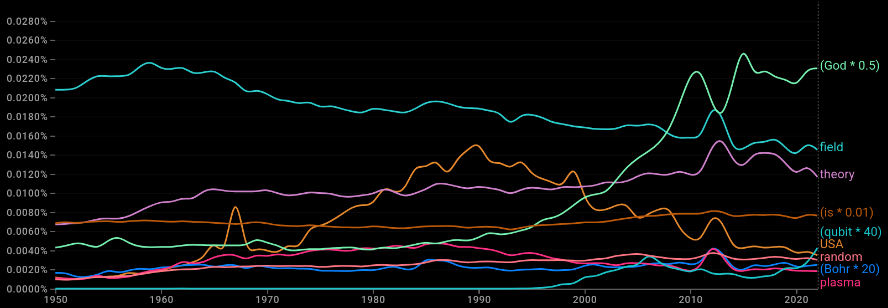


Figure 6: Google ngram ratios over time.

What next?

What next?



Credit: *books.google.com/ngrams*

Figure 7: Correlated memes.

What next?

$$dm_i = A_i(\{m\}, t)dt + B_i(\{m\}, t)dW_i \tag{6}$$

What next?

$$
\begin{aligned}
dm_i &= A_i(\{m\}, t)dt + B_i(\{m\}, t)dW_i \\
d\alpha_i &= {}^{\alpha}A_i(\{m\}, t)dt + {}^{\alpha}B_i(\{m\}, t)d^{\alpha}W_i
\end{aligned}
\tag{6}
$$

What next?

$$
\begin{aligned}
dm_i &= A_i(\{m\}, t)dt + B_i(\{m\}, t)dW_i \\
d\alpha_i &= {}^{\alpha}A_i(\{m\}, t)dt + {}^{\alpha}B_i(\{m\}, t)d^{\alpha}W_i \\
d^{\alpha}\alpha_i &= {}^{\alpha\alpha}A_i(\{m\}, t)dt + {}^{\alpha\alpha}B_i(\{m\}, t)d^{\alpha\alpha}W_i
\end{aligned} \tag{6}
$$

What next?

$$
\begin{aligned}
dm_i &= A_i(\{m\}, t)dt + B_i(\{m\}, t)dW_i \\
d\alpha_i &= {}^{\alpha}A_i(\{m\}, t)dt + {}^{\alpha}B_i(\{m\}, t)d^{\alpha}W_i \\
d^{\alpha}\alpha_i &= {}^{\alpha\alpha}A_i(\{m\}, t)dt + {}^{\alpha\alpha}B_i(\{m\}, t)d^{\alpha\alpha}W_i \\
& \dots
\end{aligned}
\tag{6}
$$

What next?

$$
\begin{aligned}
dm_i &= A_i(\{m\}, t)dt + B_i(\{m\}, t)dW_i \\
d\alpha_i &= {}^{\alpha}A_i(\{m\}, t)dt + {}^{\alpha}B_i(\{m\}, t)d^{\alpha}W_i \\
d^{\alpha}\alpha_i &= {}^{\alpha\alpha}A_i(\{m\}, t)dt + {}^{\alpha\alpha}B_i(\{m\}, t)d^{\alpha\alpha}W_i \\
&\dots
\end{aligned} \tag{6}
$$

strange loop!

What next?

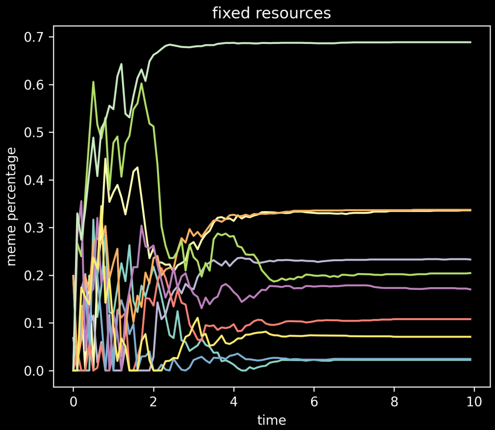


Figure 8: Random ratios.

What next?

- more detailed dynamics

What next?

- more detailed dynamics
- laboratory tests

What next?

- more detailed dynamics
- laboratory tests
- fit actual data (nifty?)

What next?

- more detailed dynamics
- laboratory tests
- fit actual data (nifty?)
- more data

Takeaway

Takeaway:
memes obey the laws of physics!

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memes obey the laws of physics!

Areas? Astro, particles, bio, medicine, condensed matter, industry, …[Enß25]

Takeaway: memes obey the laws of physics!

Areas? Astro, particles, bio, medicine, condensed matter, industry, memes? ...[Enß25]

$$\left(\frac{1}{\int_{\arccos 1}^{\arctan 1} \sin(x)\cos(x)dx}\right)! = 24$$

$$\left(\frac{1}{\int_{\arccos 1}^{\arctan 1} \sin(x)\cos(x)dx}\right)! = 24$$

$$\left(\sum (1+1)+1\right)! = 24$$

$$\left(\frac{1}{\int_{\arccos 1}^{\arctan 1} \sin(x)\cos(x)dx}\right)! = 24$$

$$\left(\sum(1+1)+1\right)! = 24$$

$$\left(\frac{(y-y)!}{\int_{\arccos((y-y)!)\times 17\times 17\times 17\times 17\times 17\times 17\times 17}^{\arctan((y-y)!)} \sin(x)\cos(x)dx}\right)! = 24$$

$$\left(\frac{1}{\int_{\arccos 1}^{\arctan 1} \sin(x)\cos(x)dx}\right)! = 24$$

$$\left(\sum(1+1)+1\right)! = 24$$

$$\left(\frac{(y-y)!}{\int_{\arccos((y-y)!)\times 17\times 17\times 17\times 17\times 17\times 17\times 17}^{\arctan((y-y)!)} \sin(x)\cos(x)dx}\right)! = 24$$

It may seems like a philosophically void exercise to go through all this trouble to show something specific to 24. All one has to do, is reverse the digits to realise its cosmic significance! [Joh19]

Thank you Beyoncé

Acknowledgements

- raw templates: imgflip, reddit
- meme generation: imgflip

References

[Mic+11] Jean-Baptiste Michel et al. "Quantitative Analysis of Culture Using Millions of Digitized Books". In: *Science* 331.6014 (2011), pp. 176–182. DOI: 10.1126/science.1199644.

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[Joh19] Vishal Johnson. *Twenty Four*. 2019. URL: https://vslyo.github.io/twenty-four.pdf.