Carbon Footprint: Thinking

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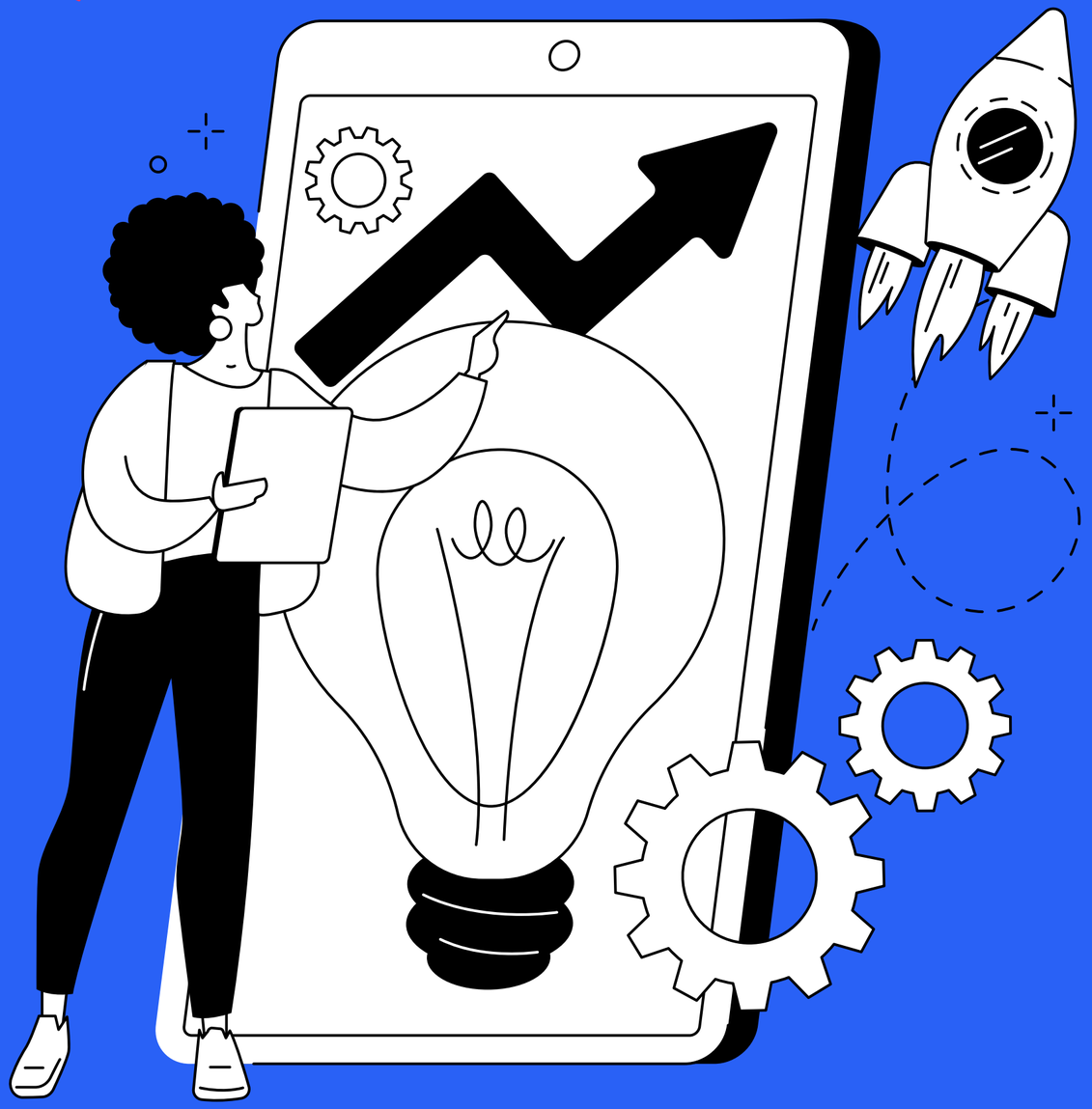

“Little things make the biggest difference”

What is Carbon Footprint?

BBC food magazine: 1999

Could the act of thinking itself could cause some level of environmental impact

Far-fetched, philosophical, but deliberate

Areas

Direct Biological Process

Indirect Cognitive Impacts

Social media

Environmental & Externalities

Profession

Research Questions

01 How do cognitive processes and mental activities impact the body's metabolic rate and overall carbon dioxide production?

02 What are the primary indirect sources of carbon emissions associated with cognitive activities?

03 What external factors that stimulate cognition (e.g., technology use, physical environments, lifestyle choices) contribute to the carbon footprint of thinking?

Research

Existing Landscape: The intersection of cognitive science and environmental science remains underexplored and has been either one or the other.

The existing body of research on carbon footprints mostly only focuses on direct emissions from physical activities and industrial processes. Wiedmann and Minx

The brain, despite comprising only about 2% of the body's weight, accounts for approximately 20% of the body's total energy consumption (Sokoloff, 1989).

Malmodin and Bergmark (2015) investigated the carbon emissions associated with ICT usage, revealing that the proliferation of digital devices and internet usage makes way for a surge in global emissions.

According to estimates, ChatGPT emits 8.4 tons of carbon dioxide per year, approximately 0.382 g CO2e per query. According to the study, Microsoft utilised around 700,000 litres of freshwater for training GPT-3 in its data centres.

How to define CO2 of thought quantitatively?

Direct Emissions Calculator

Harris-Benedict equation: RMR

An example of a a 30-year-old male weighing 70 kg and 175 cm tall is taken: CO2 Production is approx. 71.22 grams CO2/day

3.2 Direct Emissions Calculator

An established formula is employed to estimate the Resting Metabolic Rate (RMR) of individuals based on factors like age, sex, weight, and height. In this case, the Harris-Benedict equation is a commonly used method:

For men: RMR = 88.362 + (13.397 × weight in kg) + (4.799 × height in cm) - (5.677 × age in years)

For women: RMR = 447.593 + (9.247 × weight in kg) + (3.098 × height in cm) - (4.330 × age in years)

An example of a a 30-year-old male weighing 70 kg and 175 cm tall is taken

RMR = 88.362 + (13.397 × 70) + (4.799 × 175) - (5.677 × 30)

RMR = 88.362 + 937.79 + 839.825 - 170.31

RMR is approx. 1695.67 kcal/day

Next the proportion of the RMR attributed to brain activity which typically accounts for approximately 20 percent of the body's energy consumption at rest (Raichle and Mintun, 2006)

Therefore, Brain Energy Expenditure:

Brain Energy Expenditure = 1695.67 × 0.2

Brain Energy Expenditure approx. 339.13 kcal/day

Incremental Energy Consumption for Cognitive Tasks:

With different cognitive tasks, research indicates that intense mental activities can increase the brain's energy consumption by 5-10 percent.

Additional Energy for Cognitive Tasks = Brain Energy Expenditure × 0.05 (for 5 percent increase)

Additional Energy for Cognitive Tasks = 339.13 × 0.05

Additional Energy for Cognitive Tasks is approx. 16.96 kcal/day

Carbon Dioxide Production:

Now, the energy consumption is translated into CO2 production. The average conversion factor for energy expenditure to CO2 production is about 0.2 kg CO2 per kcal burned.

CO2 Production from Brain Activity = (Brain Energy Expenditure + Additional Energy for Cognitive Tasks) × 0.2

Total Brain Energy = 339.13 + 16.96

Total Brain Energy is approx. 356.09 kcal/day

CO2 Production:

CO2 Production from Brain Activity = 356.09 × 0.2

CO2 Production is approx. 71.22 grams CO2/day

Technology Dependency and Environmental Concerns

Environmental Consciousness and Behavioural Adaptations

Role of Physical Environments in Cognitive Stimulation and Well-being

Qualitative Research

Interviews

Semi-structured interviews were conducted with 20 participants to explore what external factors that stimulate cognition contribute to the carbon footprint of thinking

One respondent says "I rely on my smartphone and laptop for work, but I'm also aware that every time I charge my devices or use them for extended periods, I'm contributing to energy consumption and greenhouse gas emissions. It's a dilemma because I value the convenience technology offers, but I'm also concerned about its environmental impact."

So now what has it been proved?

Analysis

1. if a 30-year-old male produces approximately 71.22 grams CO2/day, then if we multiplied that with 365 days and a population of 10,000 then that is 260 million grams of CO2 a year, solely biological.
2. More and more indirect emissions are generated
3. Under harsher conditions comes more intensity of brain usage.

Final notes! and some suggestions

Obviously, we cannot stop thinking as it is part of our biology which is why this paper tries to at least raise education about how if even the things we do not have much control over can impact the environment, then it is necessary to start taking initiatives that we do infact have control over.

and some suggestions...

1. Wellbeing Tools can be implemented to balance the mind and its thinking, such as, doing yoga, attending therapy if required, mindfulness, or other lifestyle choices that reduce the use of digital devices and instead help keep you in tune with nature to harmonise the chaos of the brain.
2. Switching to energy-efficient devices and software settings to minimise energy consumption during cognitive activities can be a small initiative that could go a long way.
3. Many businesses should design their work and study environments to incorporate elements of nature and optimise lighting and air quality to enhance cognitive well-being while minimising energy consumption.

questions?

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Ultimately, by raising awareness and implementing practical strategies, sustainability can also be thought of as something within us where even our cognitive well-being can produce positive benefits for the planet.

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