

# Schools K-12 Should Ban Smartphones as a Top-Down Policy

Anna Lembke, MD

Professor of Psychiatry and Medical Director of Addiction Medicine

Stanford University School of Medicine

Oklahoma Senate Meeting

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# Disclosures

- I do not receive any funding, fees, stock options, or other compensation from companies that make, market, or disseminate medical products.
- I have been retained as a medical expert witness in federal, state, and county opioid litigation against opioid manufacturers, distributors, and pharmacies.
- I have been retained as a medical expert witness in federal, state, and county social media litigation.

# Learning Objectives

- Explain the neuroscience of pleasure and pain and what happens in the brain as we repeatedly consume high-dopamine rewards.
- Describe *homeostasis* and how chronic exposure to rewarding stimuli tilts the hedonic set-point to the side of pain.
- Explore how overconsumption of digital media is a causal risk factor for depression and anxiety.

# What is Addiction?

- The continued compulsive use of a substance or behavior despite harm to self and or others.
- A complex biopsychosocial disease
- A treatable disorder

# The Reward Circuit

## DOPAMINE REWARD PATHWAYS IN THE BRAIN

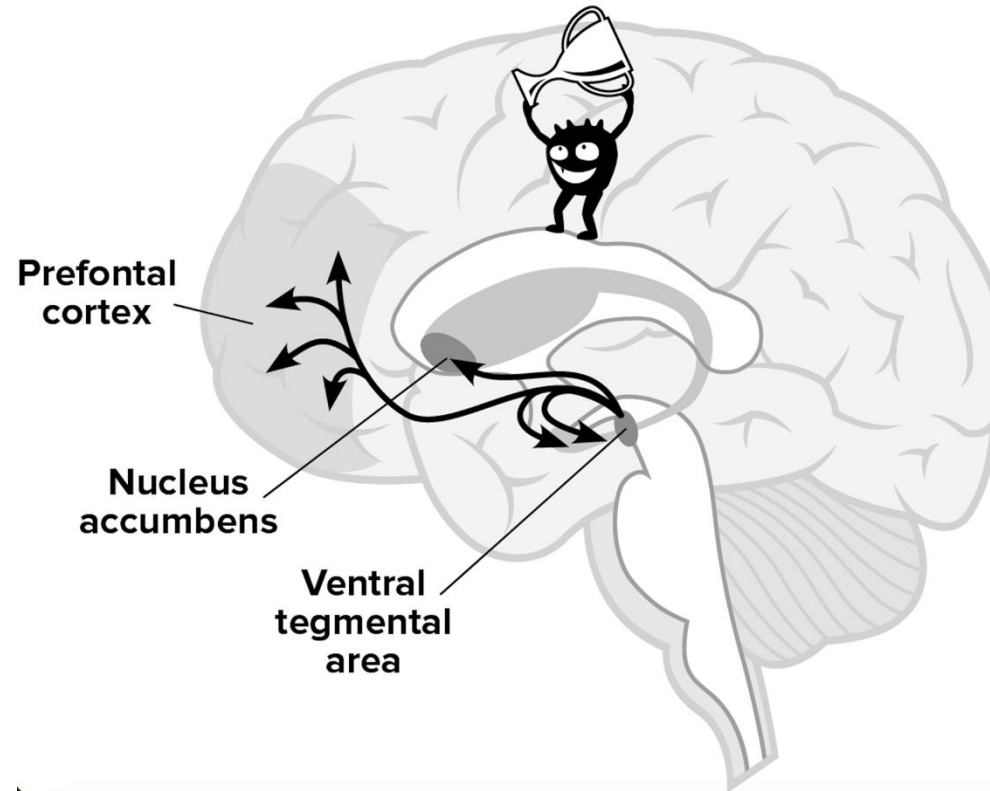


Image from *Dopamine Nation: Finding Balance in the Age of Indulgence*,  
Dutton Penguin Random House, 2021

# Dopamine

## NEUROTRANSMITTER

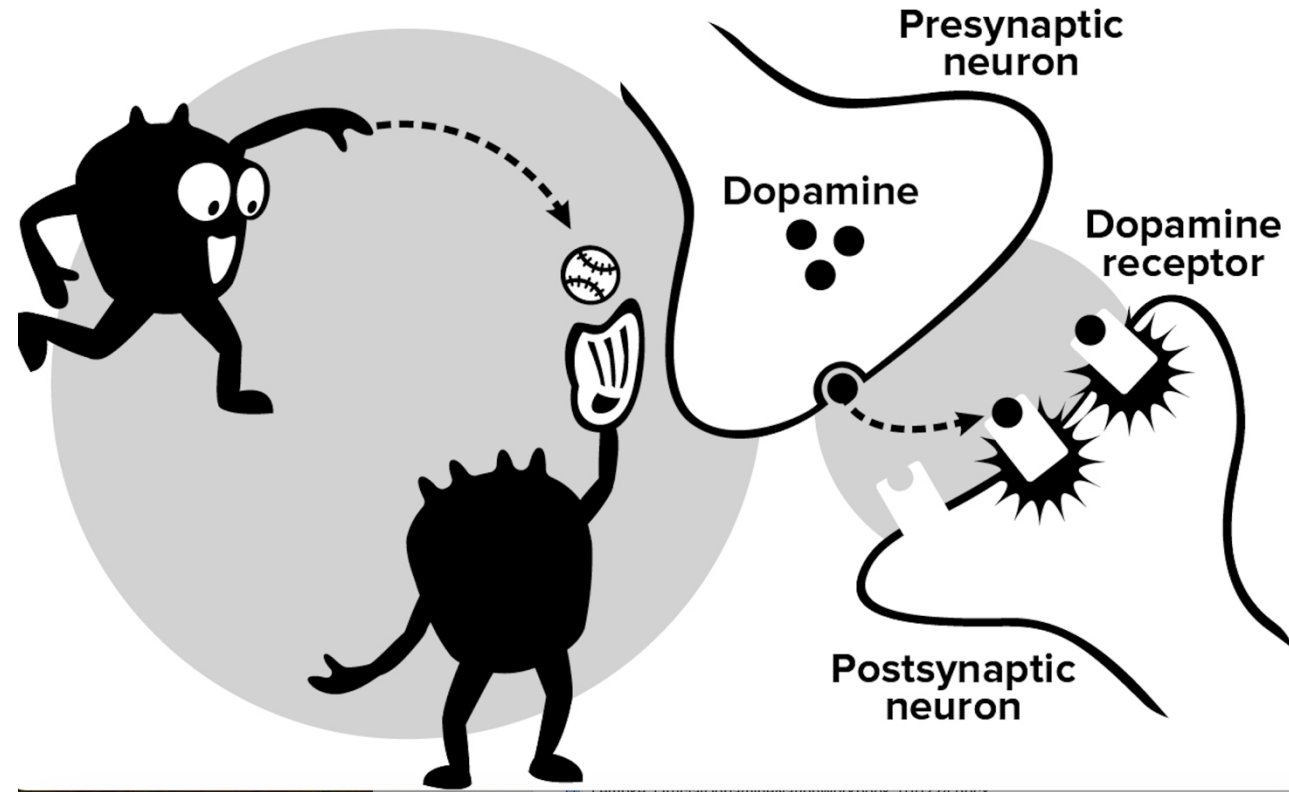


Image from *Dopamine Nation: Finding Balance in the Age of Indulgence*,  
Dutton Penguin Random House, 2021

# Dopamine as a Universal Reward Currency



## REWARDS AND DOPAMINE RELEASE

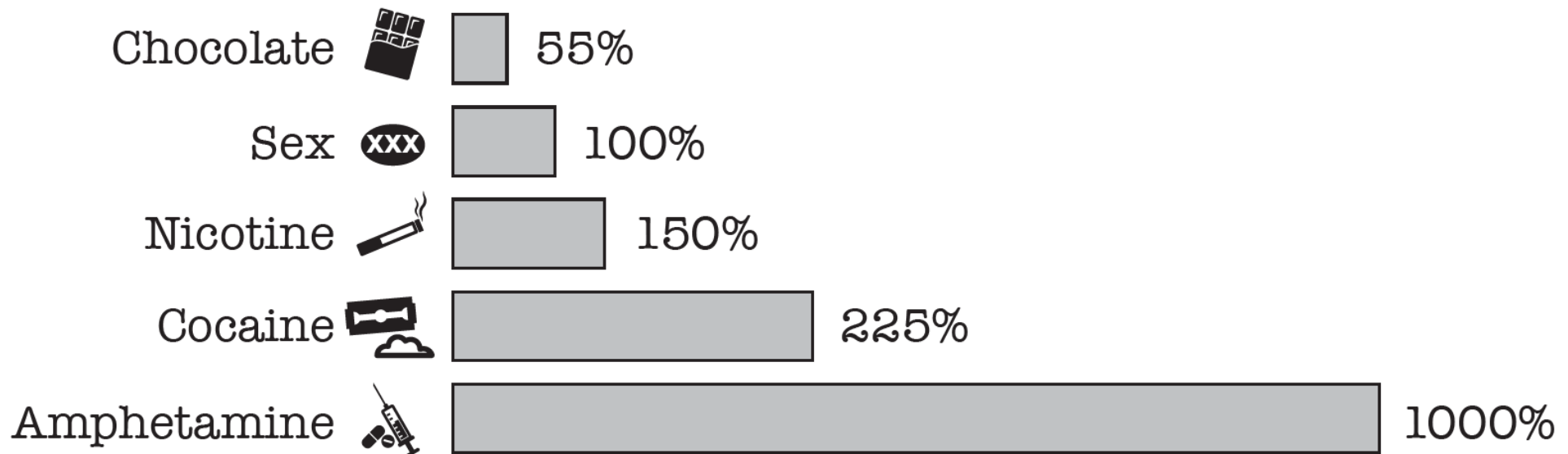


Image from *Dopamine Nation: Finding Balance in the Age of Indulgence*,  
Dutton Penguin Random House, 2021

# Rat Selfies



No higher resolution available.

[Augustin\\_Lignier\\_rat\\_selfie\\_1\\_\(cropped\).jpg](#) (530 x 509 pixels, file size: 108 KB, MIME type: ima



Éthologie

**Les rats aiment-ils les  
"selfies" ?**



# Human Brain fMRI Studies and Social Rewards

Cell  
PRESS

Neuron  
Article

## Processing of Social and Monetary Rewards in the Human Striatum

Keise Izuma,<sup>1,2</sup> Daisuke N. Saito,<sup>1,3</sup> and Norihiro Sadato<sup>1,2,3,4,\*</sup>

<sup>1</sup>Department of Cerebral Research, Division of Cerebral Integration, National Institute for Physiological Sciences (NIPS), Aichi, Japan

<sup>2</sup>Department of Physiological Sciences, School of Life Sciences, The Graduate University for Advanced Studies, Kanagawa, Japan

<sup>3</sup>Japan Science and Technology Agency (JST)/Research Institute of Science and Technology for Society (RISTEX), Tokyo, Japan

<sup>4</sup>Biomedical Imaging Research Center (BIRC), University of Fukui, Fukui, Japan

\*Correspondence: sadato@nips.ac.jp

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### SUMMARY

Despite an increasing focus on the neural basis of human decision making in neuroscience, relatively little attention has been paid to decision making in social settings. Moreover, although human social decision making has been explored in a social psychology context, few neural explanations for the observed findings have been considered. To bridge this gap and improve models of human social decision making, we investigated whether acquiring a good reputation, which is an important incentive in human social behaviors, activates the same reward circuitry as monetary rewards. In total, 19 subjects participated in functional magnetic resonance imaging

when the benefits of doing so outweigh the costs. Importantly, the benefits in such a case take the form not only of material rewards, such as food and money, but also of more abstract rewards, such as social approval from others. This theory provides a base from which to explore complex human social decision making and behaviors in the simple terms of “reward.”

In the present study, from among the many possible rewards in human social interactions, we focused on an individual's reputation or the impression of an individual formed by others. The importance of processing one's own reputation in human social decision making has been highlighted by the theoretical research on the evolution of human cooperation (Fehr and Fischbacher, 2003). It has been shown that cooperation in iterated games is significantly affected by the concern for reputation (Kreps and Wilson, 1982), and that an individual's motivation to acquire a good reputation or “image score” (Milinski et al.,

- 19 human subjects
- “The acquisition of one’s good reputation robustly activated reward-related brain areas”
- Supports “common neural circuitry” for rewards

# Human Brain fMRI Study Predicts Facebook Use

frontiers in  
**HUMAN NEUROSCIENCE**

ORIGINAL RESEARCH ARTICLE  
published: 29 August 2013  
doi: 10.3389/fnhum.2013.00439



## Nucleus accumbens response to gains in reputation for the self relative to gains for others predicts social media use

**Dar Meshi**<sup>1,2,3,4\*</sup>, **Carmen Morawetz**<sup>1,2,3</sup> and **Hauke R. Heekeren**<sup>1,2,3,4</sup>

<sup>1</sup> Cluster of Excellence "Languages of Emotion," Freie Universität Berlin, Berlin, Germany

<sup>2</sup> Department of Education and Psychology, Freie Universität Berlin, Berlin, Germany

<sup>3</sup> Dahlem Institute for the Neuroimaging of Emotion, Freie Universität Berlin, Berlin, Germany

<sup>4</sup> Berlin School of Mind and Brain, Humboldt Universität zu Berlin, Berlin, Germany

### Edited by:

Leonhard Schilbach, University Hospital Cologne, Germany

### Reviewed by:

Daniel Campbell-Meiklejohn, Aarhus University, Denmark

Keise Izuma, California Institute of Technology, USA

### \*Correspondence:

Dar Meshi, Department of Education and Psychology, Freie Universität Berlin, Habelschwerdter Allee 45, 14195 Berlin, Germany  
e-mail: dar.meshi@fu-berlin.de

Our reputation is important to us; we've experienced natural selection to care about our reputation. Recently, the neural processing of gains in reputation (positive social feedback concerning one's character) has been shown to occur in the human ventral striatum. It is still unclear, however, how individual differences in the processing of gains in reputation may lead to individual differences in real-world behavior. For example, in the real-world, one way that people currently maintain their reputation is by using social media websites, like Facebook. Furthermore, Facebook use consists of a social comparison component, where users observe others' behavior and can compare it to their own. Therefore, we hypothesized a relationship between the way the brain processes specifically self-relevant gains in reputation and one's degree of Facebook use. We recorded functional neuroimaging data while participants received gains in reputation, observed the gains in reputation of another person, or received monetary reward. We demonstrate that across participants, when responding to gains in reputation for the self, relative to observing gains for others, reward-related activity in the left nucleus accumbens predicts Facebook use. However, nucleus accumbens activity in response to monetary reward did not predict Facebook use. Finally, a control step-wise regression analysis showed that Facebook use primarily explains our results in the nucleus accumbens. Overall, our results demonstrate how individual sensitivity of the nucleus accumbens to the receipt of self-relevant social information leads to differences in real-world behavior.

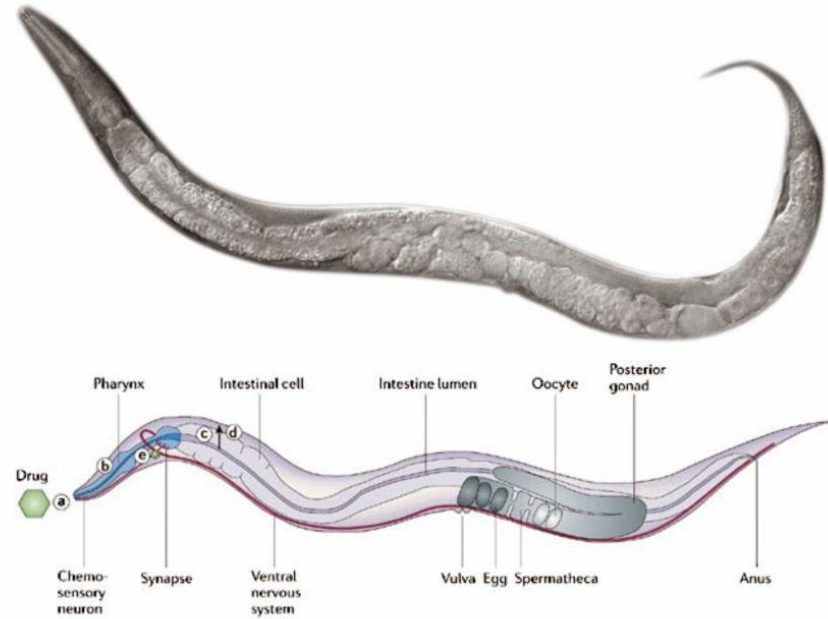
**Keywords:** reputation, impression management, social reward, social media, Facebook, nucleus accumbens, individual differences, fMRI

- fMRI data recorded while participants received gains in reputation
- Gains in self reputation stimulated nucleus accumbens (the reward pathway)
- Sensitivity of left nucleus accumbens predicts Facebook use (the degree to which people use and rely on Facebook)

# Dopamine and Movement



*Caenorhabditis elegans*  
(*C. elegans*)



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Nature Reviews | Drug Discovery

# The Pleasure Pain Balance



Image from Lembke, Anna. *Dopamine Nation: Finding Balance in the Age of Indulgence*,  
Dutton Penguin Random House, 2021

# The Pursuit of Pleasure

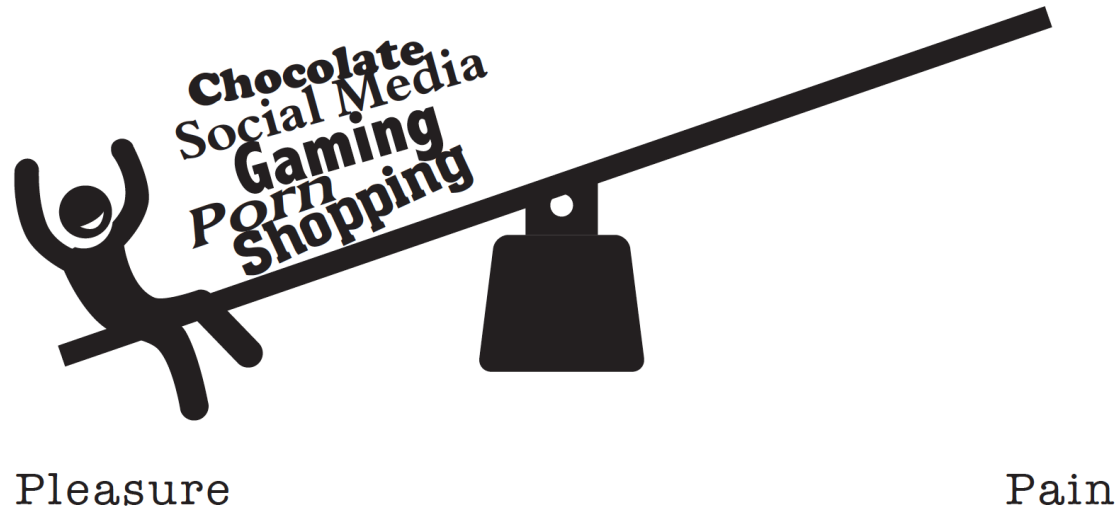


Image from Lembke, Anna. *Dopamine Nation: Finding Balance in the Age of Indulgence*,  
Dutton Penguin Random House, 2021



# The Opponent-Process Mechanism: Pain



Image from Lembke, Anna. *Dopamine Nation: Finding Balance in the Age of Indulgence*,  
Dutton Penguin Random House, 2021

# Homeostasis



Image from Lembke, Anna. *Dopamine Nation: Finding Balance in the Age of Indulgence*,  
Dutton Penguin Random House, 2021

# Neuroadaptation (Allostasis)

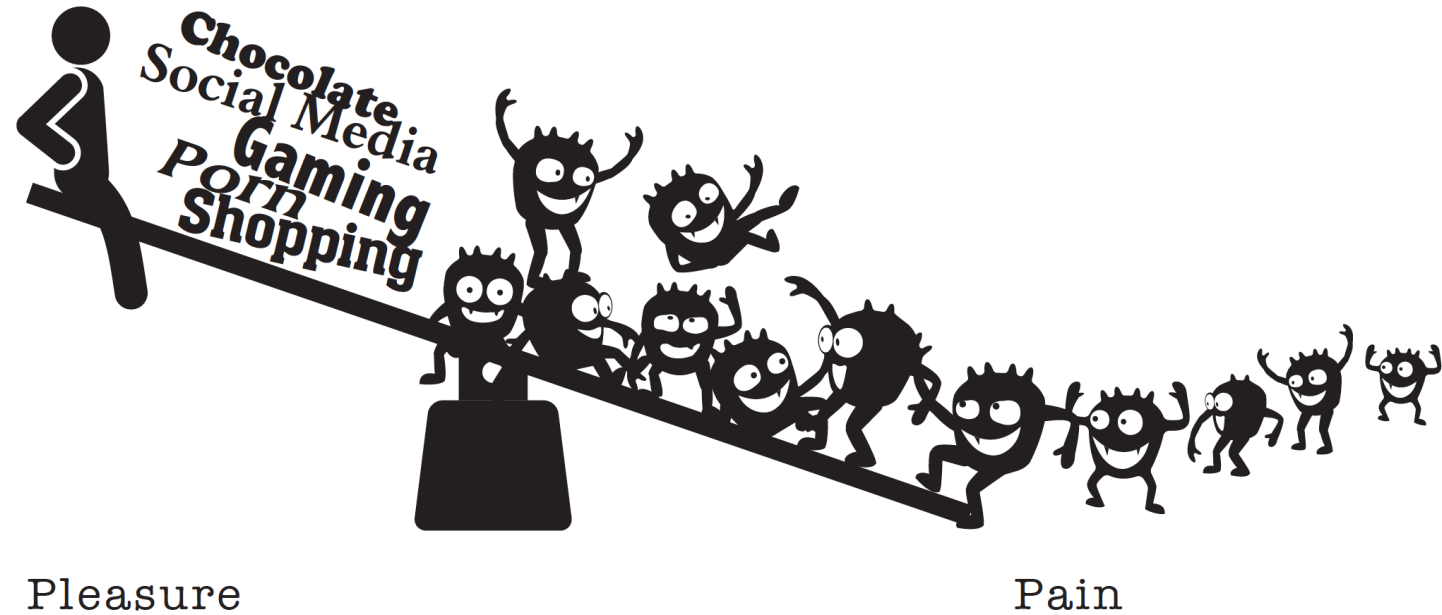


Image from Lembke, Anna. *Dopamine Nation: Finding Balance in the Age of Indulgence*,  
Dutton Penguin Random House, 2021



# Disease: Loss of Adaptability

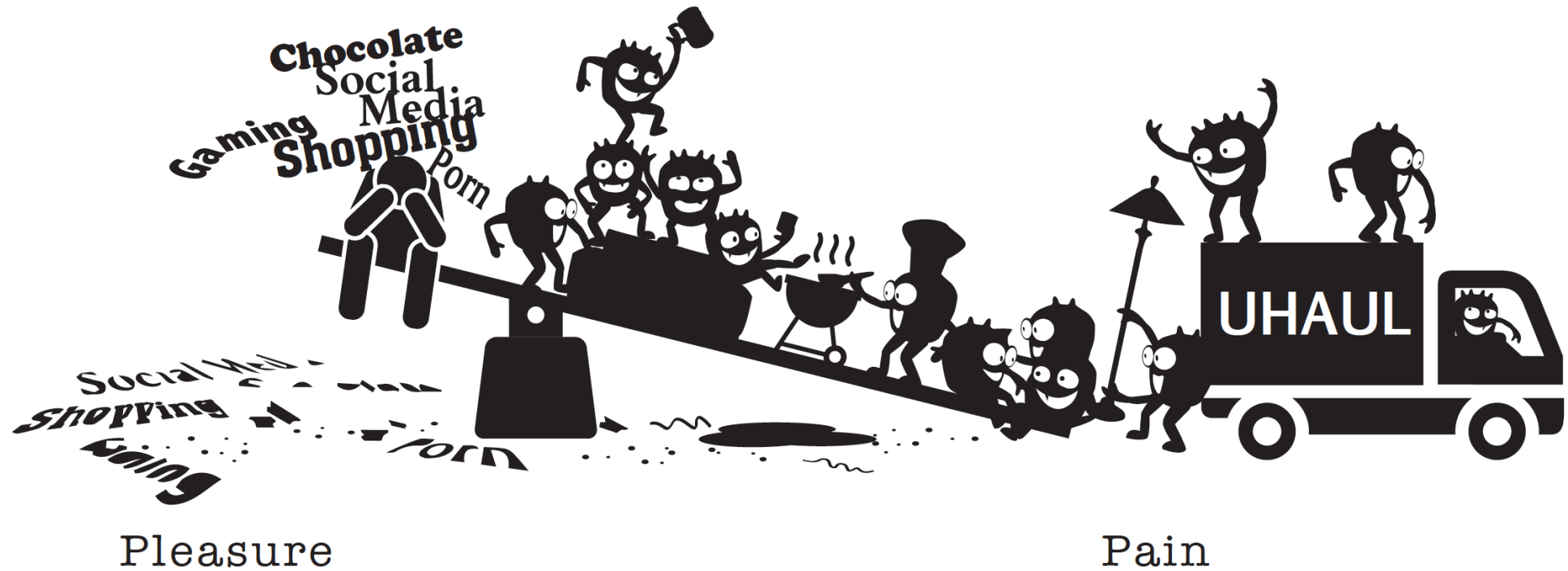


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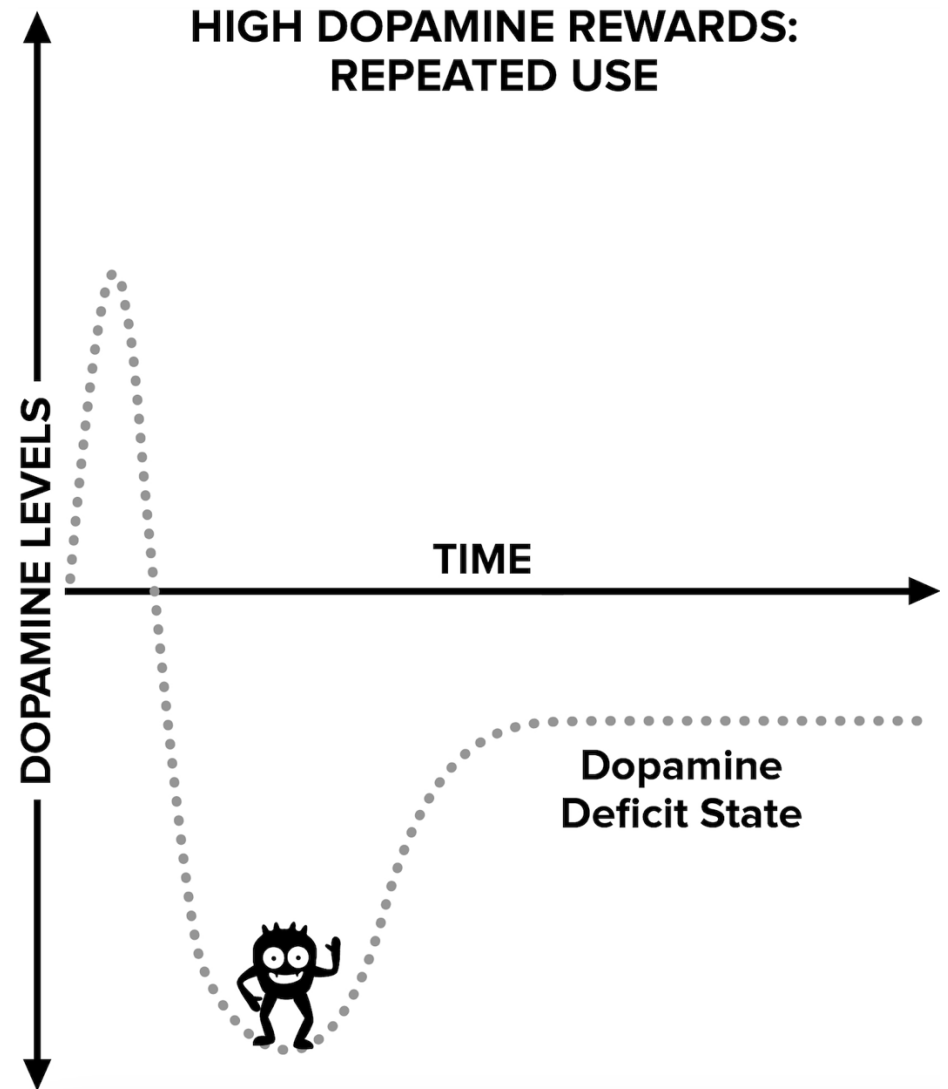
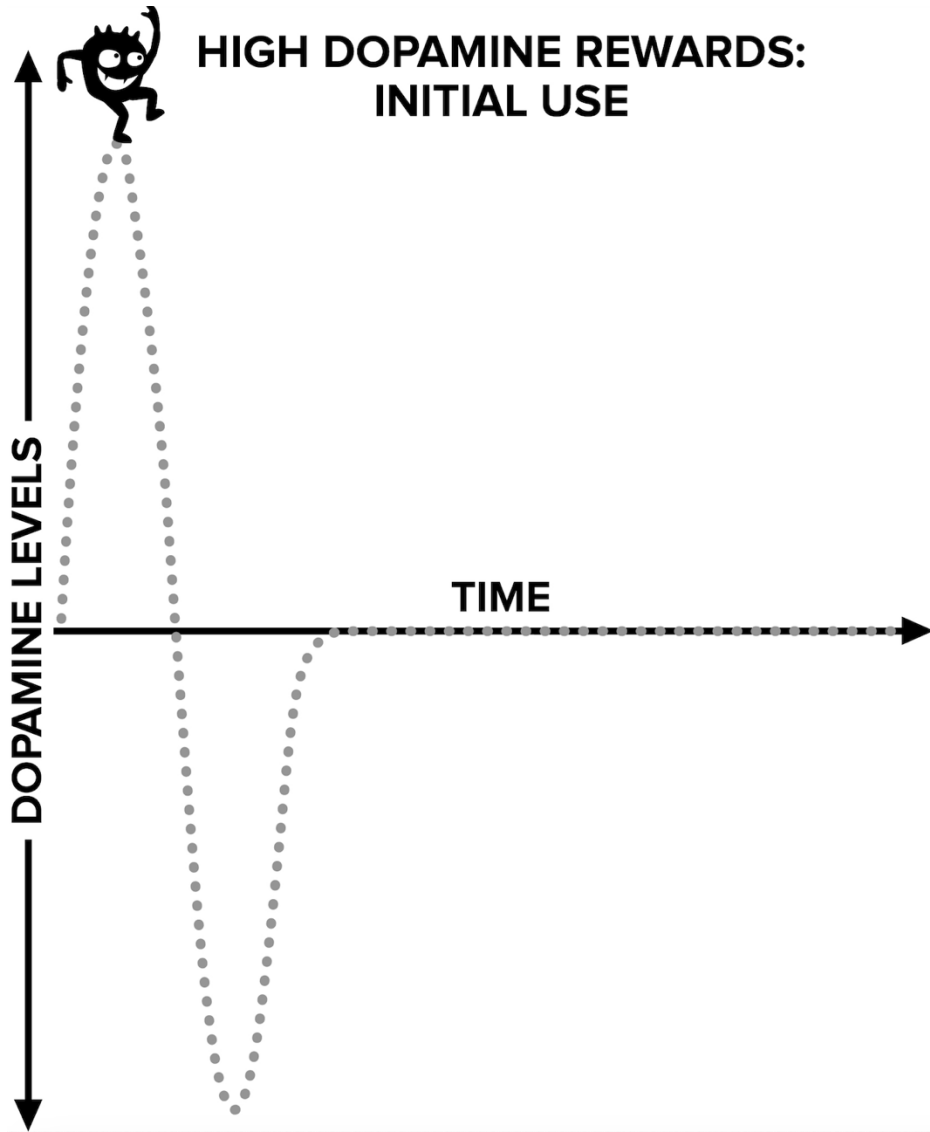
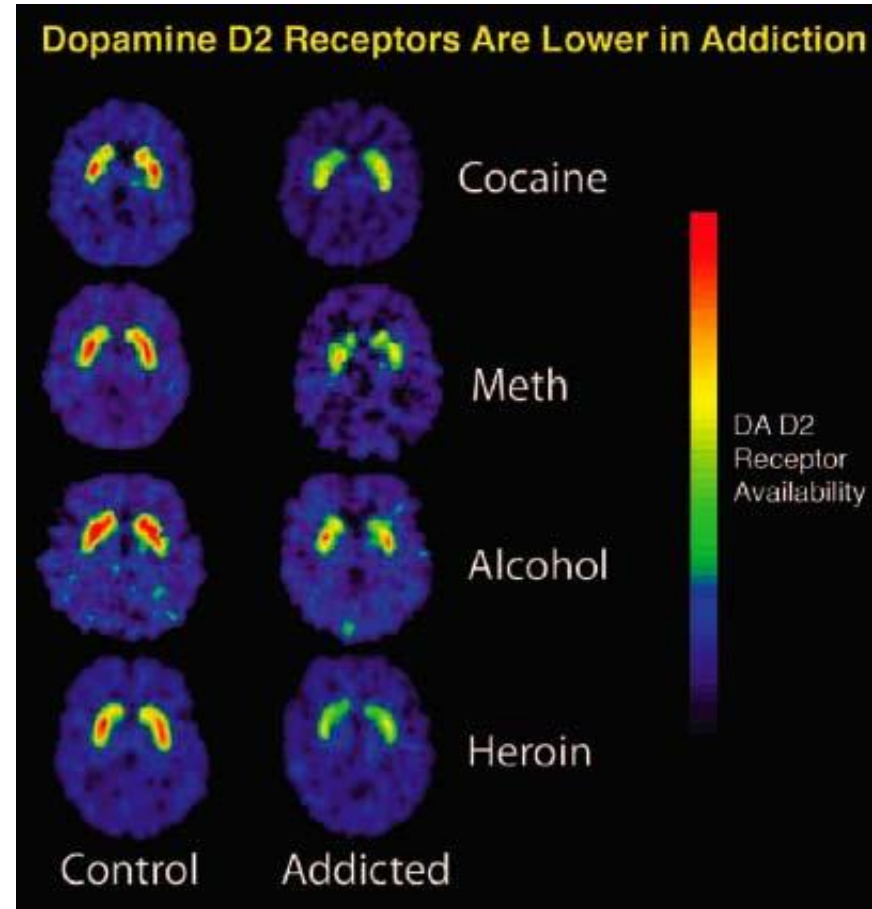


Image from Lembke, Anna. *Dopamine Nation: Finding Balance in the Age of Indulgence*,  
Dutton Penguin Random House, 2021

# The Dopamine-Deficit State



Volkow ND, et al, Behavioural Pharmacology  
2002;13:355–366

# The Balance Remembers

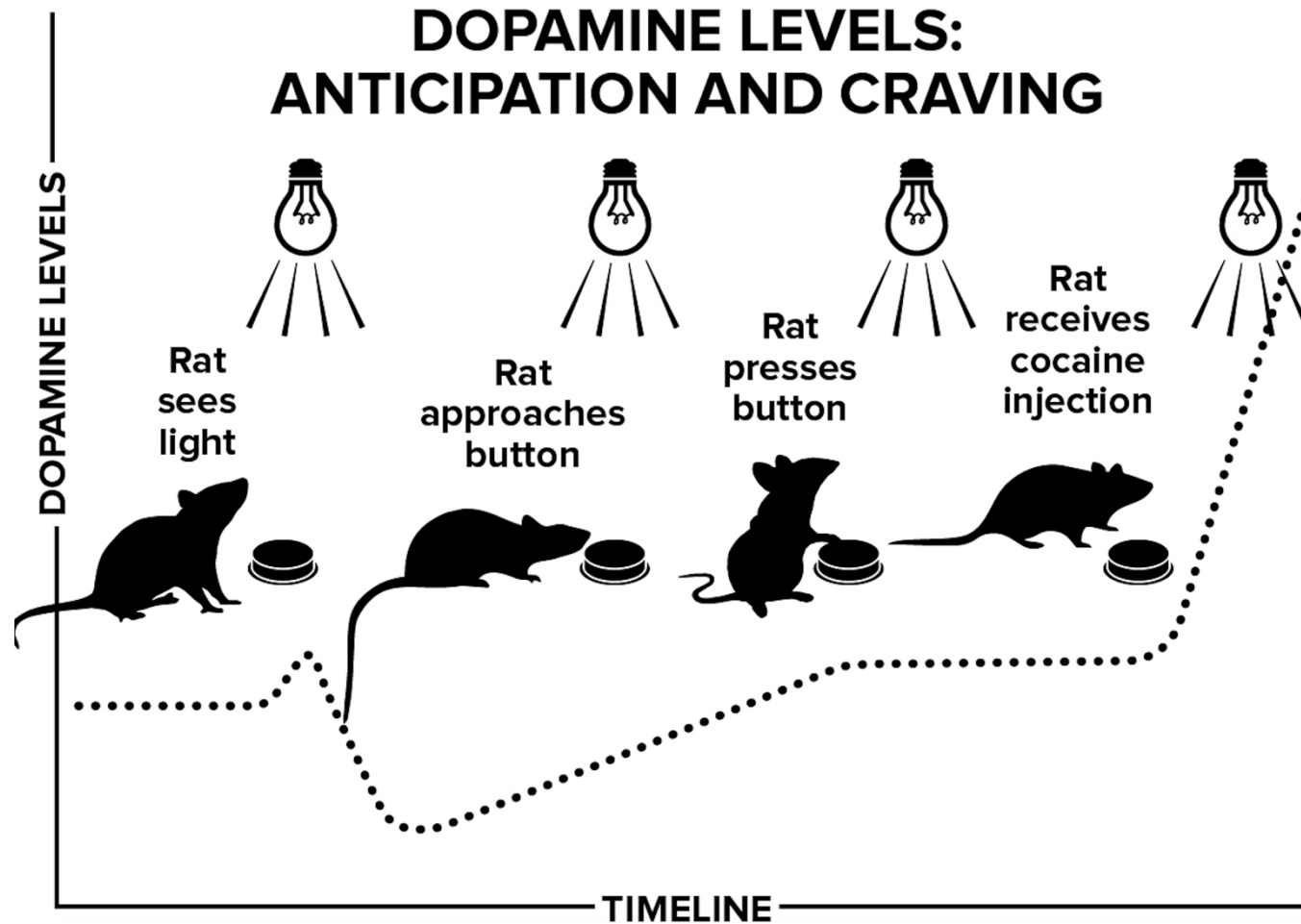


Image from Lembke, Anna. *Dopamine Nation: Finding Balance in the Age of Indulgence*, Dutton Penguin Random House, 2021

# The Disappointment of Unmet Expectations

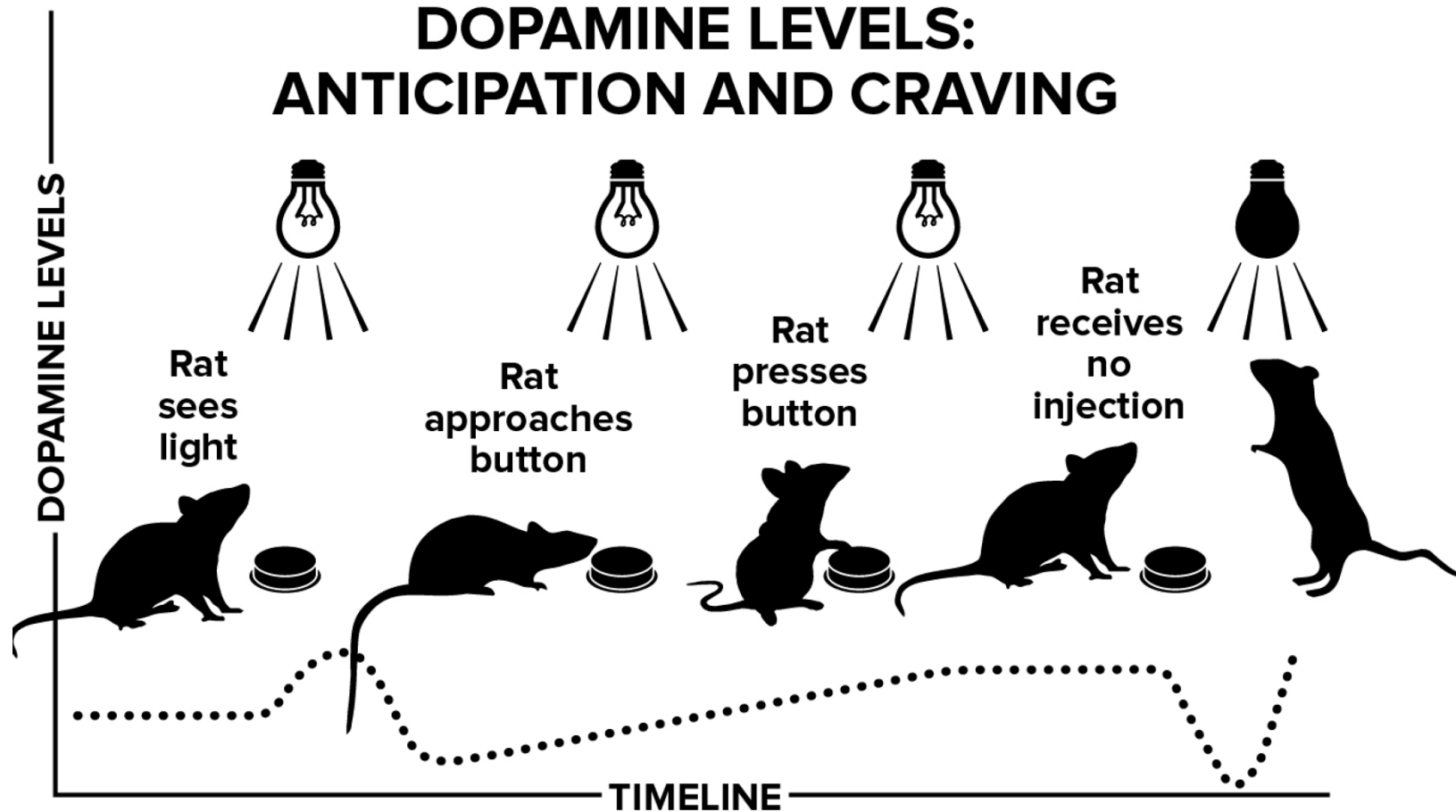
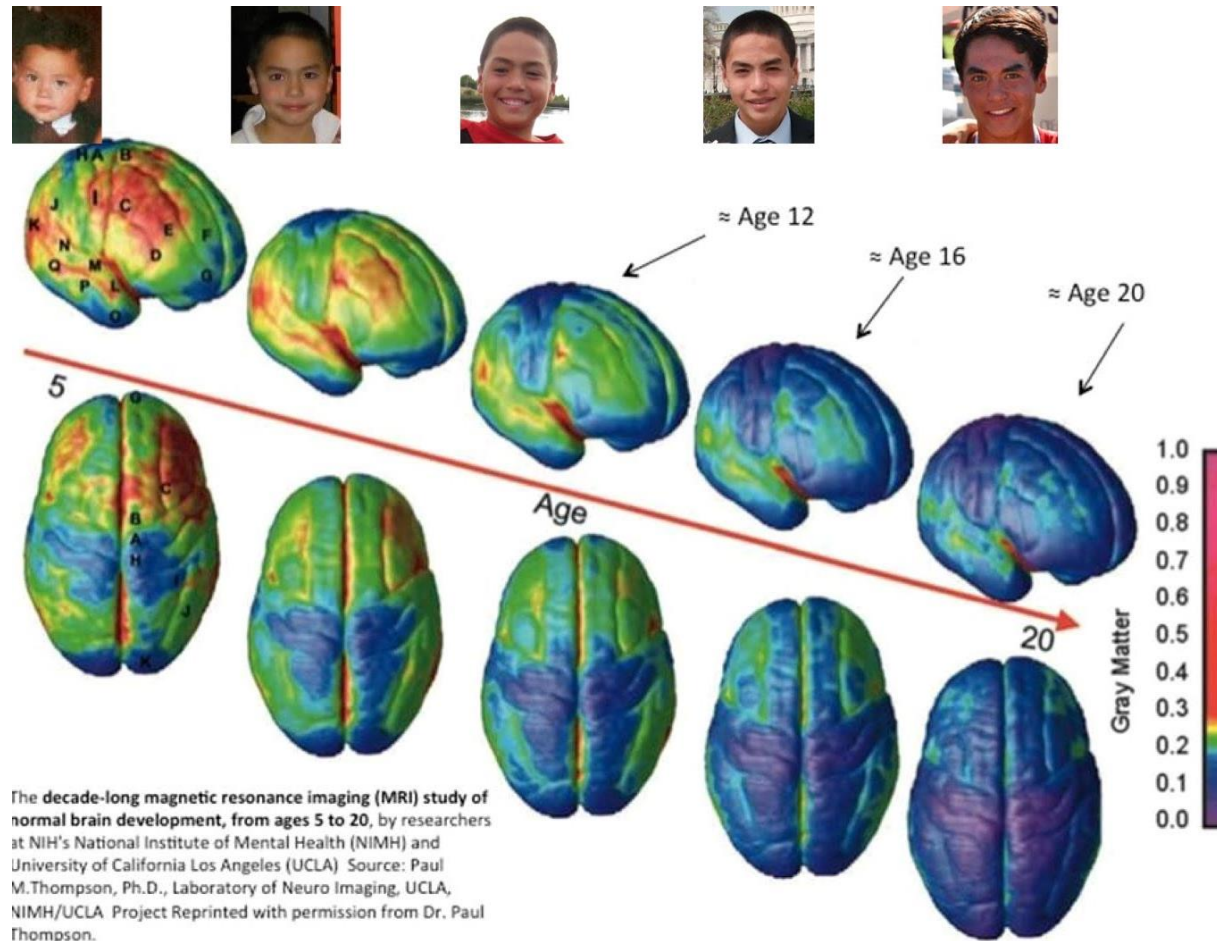


Image from Lembke, Anna. *Dopamine Nation: Finding Balance in the Age of Indulgence*,  
Dutton Penguin Random House, 2021

# The Developing Brain



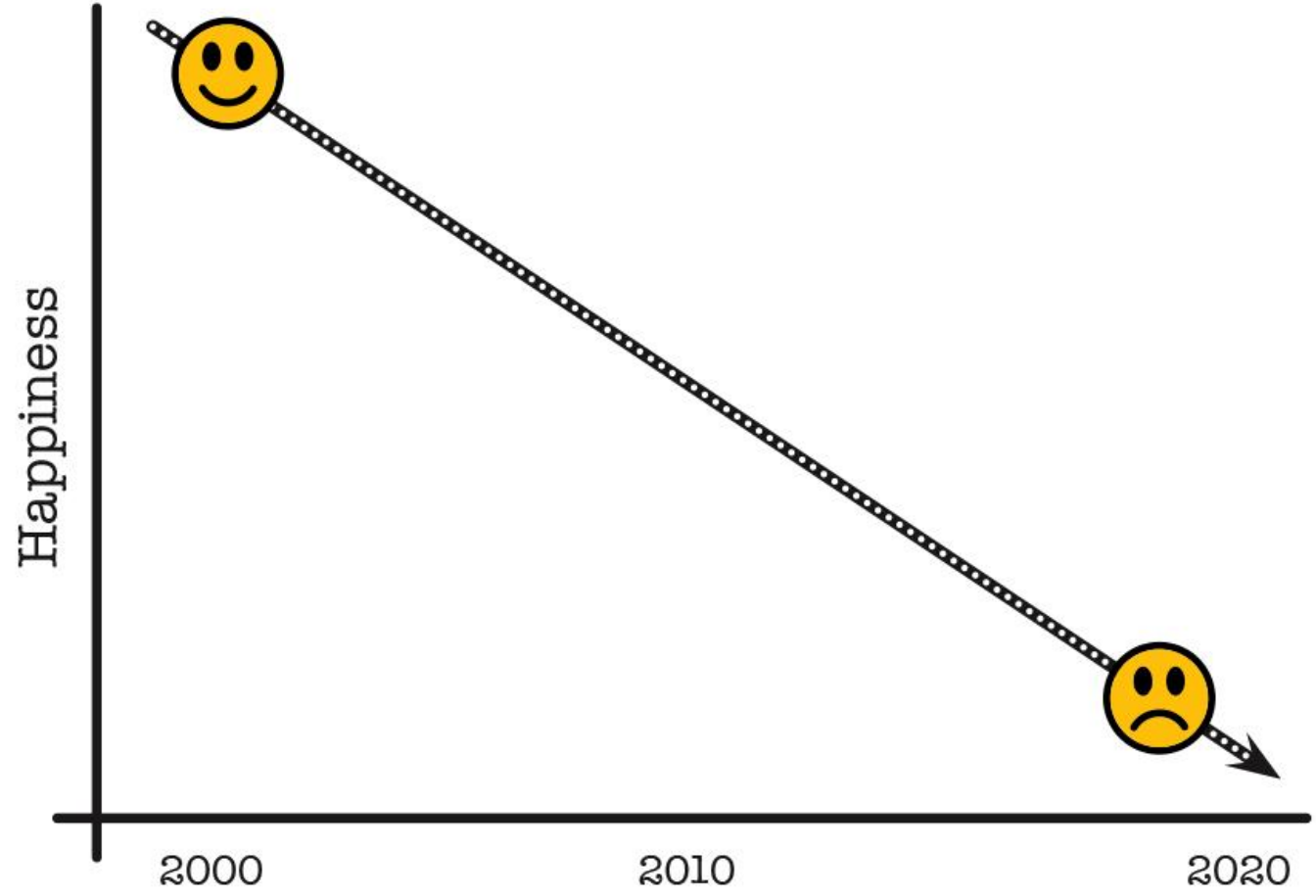
Paul M. Thompson, Ph.D. Laboratory of Neuro Imaging, UCLA,  
NIMH/UCLA

# A Druggified World

- Potency
- Quantity
- Novelty
- Access

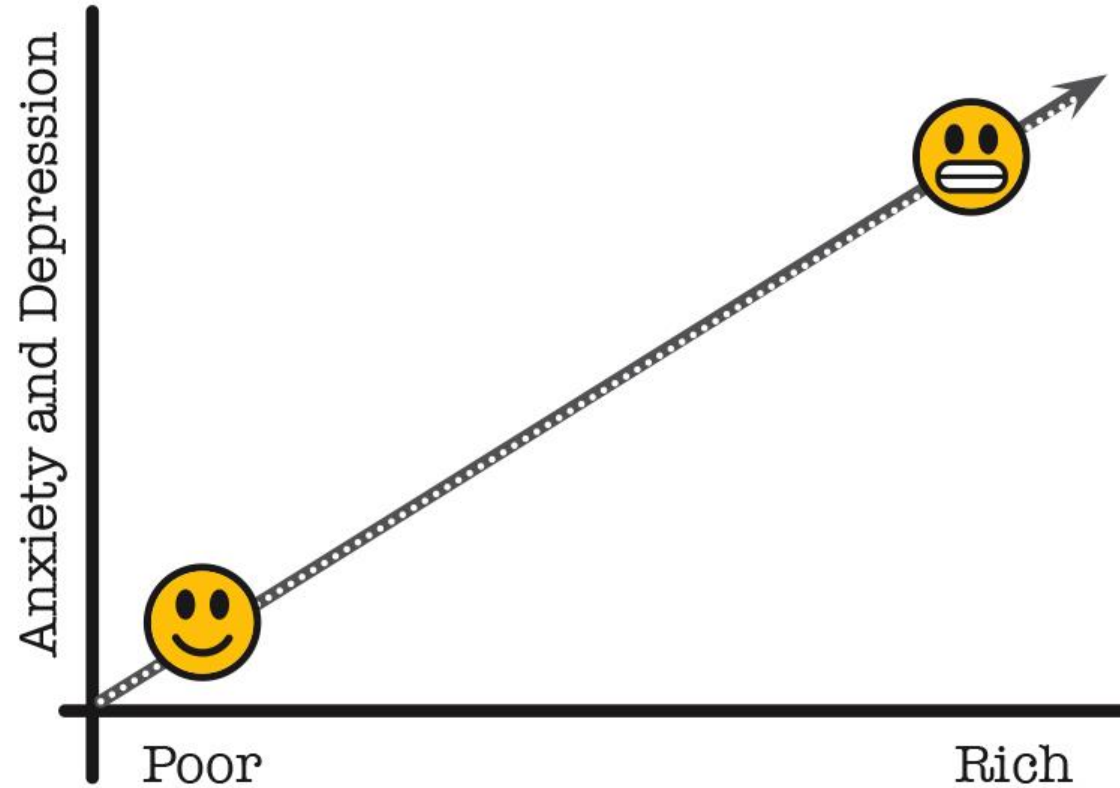


# WORLD HAPPINESS SURVEY



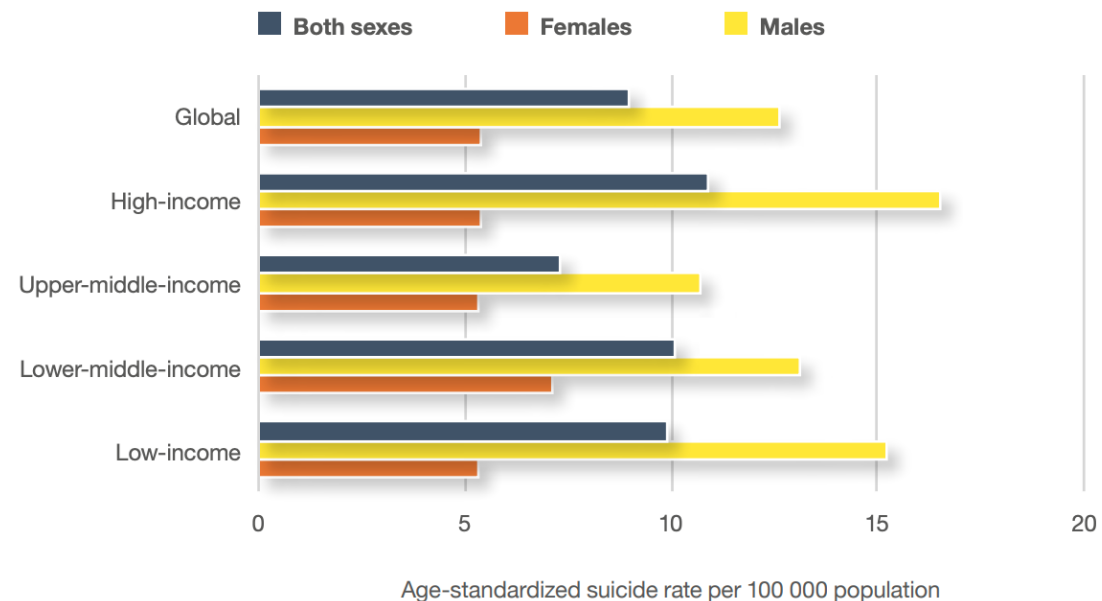


RICHER COUNTRIES HAVE HIGHER RATES OF ANXIETY AND DEPRESSION THAN POORER ONES



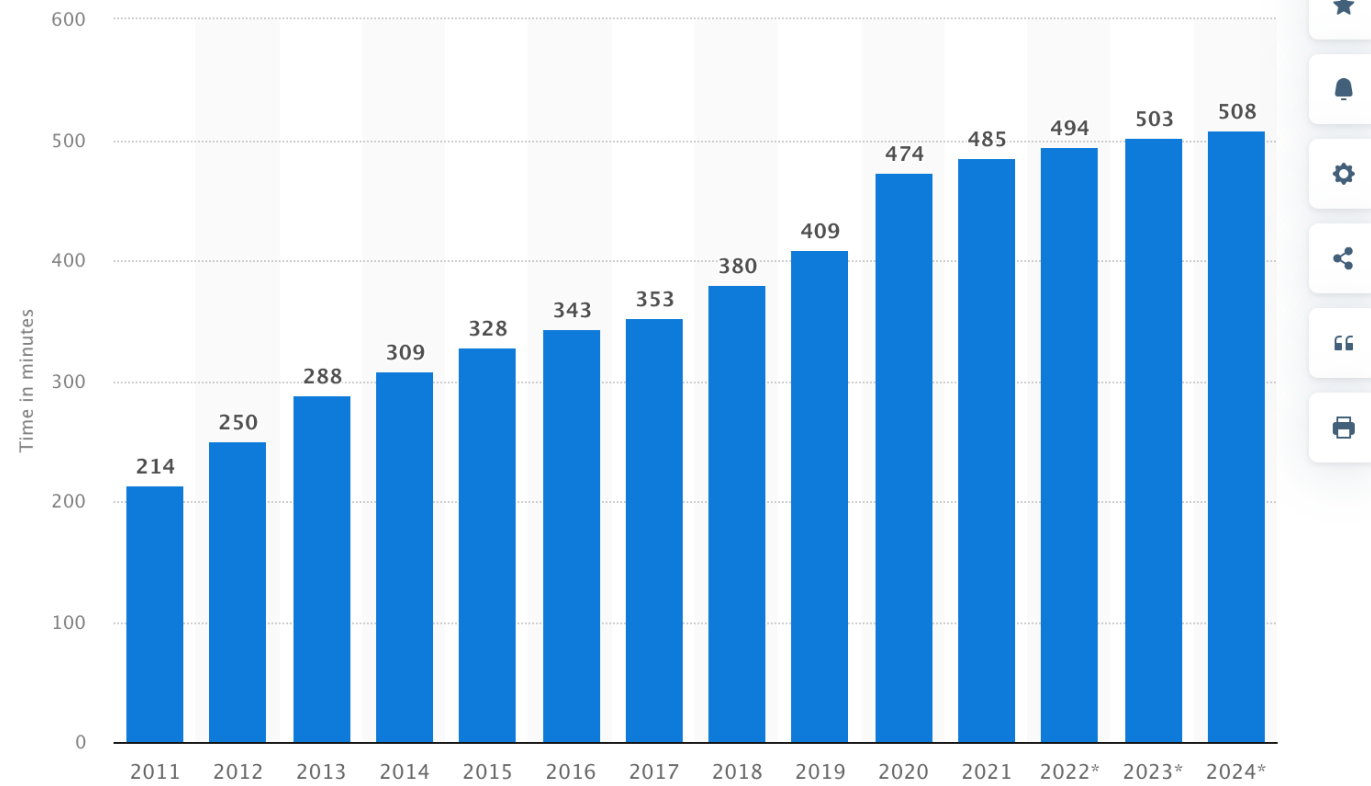
# Wealth as a Risk Factor for Depression, Anxiety, and Suicide

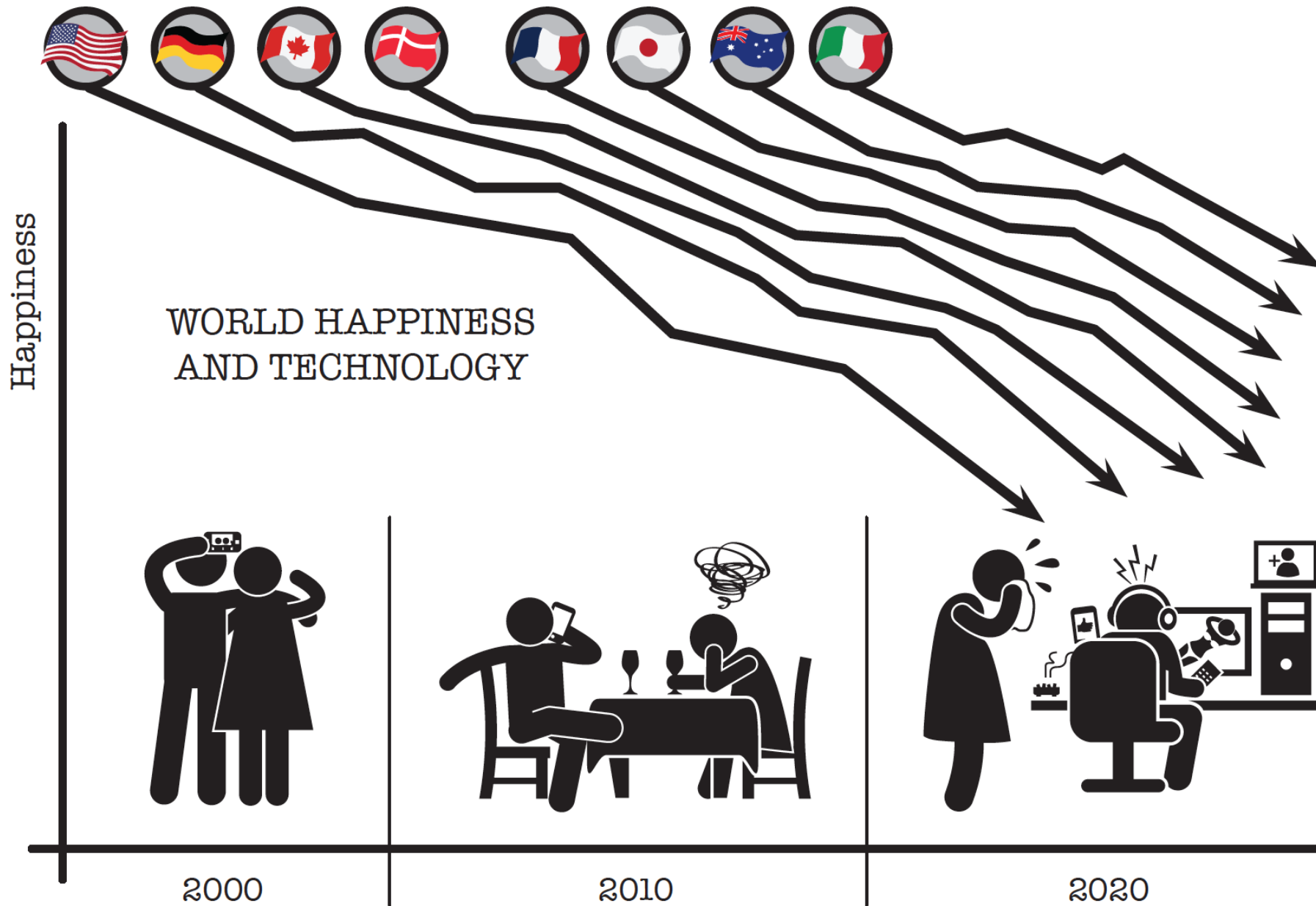
Figure 9. Age-standardized suicide rates (per 100 000 population) by country income level\*, 2019



\* World Bank income groups, 2020  
Source: WHO Global Health Estimates 2000-2019

In 2021, adults in the U.S. spent on average eight hours and five minutes with digital media each day.





# Not Just an Individual Problem

- Families
- Schools/Community
- Corporations
- Governments



# Schools Should Ban Smartphones



By [Julie Jargon](#) [Follow](#) | Photographs by [Bea Oyster](#) for *The Wall Street Journal*  
Nov. 5, 2022 9:00 am ET

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A boarding school is conducting a social experiment: a smartphone ban for all students and faculty.

Buxton School, a 57-student high school in Williamstown, in northwest Massachusetts, had always prided itself on its close-knit community, where family-style meals are eaten at round tables and students and teachers share in chores. But as smartphones became ubiquitous, faculty members say that sense of community eroded.

Students often looked down at screens during meals and even in class, where phones were prohibited. Teachers grew tired of being gadget police. Kids retreated to their rooms after class to scroll and text rather than gathering in student lounges. When the Covid-19 pandemic hit in 2020 and the school closed for a few months, class went virtual and things got worse.

NEWSLETTER SIGN-UP

## Family + Tech

Columnist Julie Jargon, a mother of three, helps families find answers and address concerns about the ways technology is impacting their lives.

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# Corporations Should Remove Addictive Design-Elements for Kids

- Stop promoted content: The AI algorithms learn what we've liked before and then send more potent, novel versions of the same, accelerating the "addiction narrative" and leading to more negative, polarizing content
- Stop tracking
- Stop targeted ads
- Stop the quantitative comparisons that drive overuse
- Make it easier for users to opt-out, de-subscribe, de-finance, etc
- Make it easier for parents to monitor use
- Require companies to share their user data
- Hold companies partially responsible for harmful use

# Governments Should Incentivize Phone-Free Schools

- There are precedents for this....
- The Federal Uniform Drinking Age Act of 1984 ties highway funds to the minimum legal drinking age of 21
  - The federal government can withhold up to 10% of highway funds from states that don't prohibit people under 21 from buying or publicly possessing alcohol.
  - The reduction in funds begins in the third fiscal year after the act is enacted and increases to 10% in the fourth year.
  - The U.S. Department of Transportation has confirmed that all states are in compliance with the act.