CSC 595 - Research Skills

Research and Ethics

Nishant Mehta

Research Ethics

vs

Ethics *of* Research

vs

Ethics *in* Research

- Difference between:
  - **ethics of human subjects research**
  - **ethics of the research goals itself** (usually not reviewed due to academic freedom, but has public opinion review)
  - **ethical conduct in research** (plagiarism, fake data, self citation, review circles)

- Ethics is rarely black and white. We have to balance competing priorities and it may not seem unethical until later. The pressure in academia can feel intense! Reach out to university counseling resources or trusted professors if you feel you need some help.

Credit: Regan Mandryk

Research Ethics

What requires human ethics approval?

- surveys and questionnaires (in-person, online, web, platforms)
- interviews (in-person, virtual, phone)
- administering experiments and user tests on crowdsourcing platforms (e.g., Amazon Mechanical Turk)
- group discussions and focus groups
- observations in non-public venues (e.g. classrooms, meetings)
- audio recording people in any of the above
- video recording people in any of the above
- taking notes of people in any of the above
- self-studies, autobiographical, auto-ethnographic and self-reflective studies
- self-experimentation (e.g., collecting data or biological samples from yourself, administering self-tests or medication)
- engaging with people and their information via Facebook, social media and crowdsourcing platforms
- social media: online posts from sites and groups that require a log-in, membership, etc.
    - these sites are not considered publicly accessible because there is reasonable expectation of privacy
- using EEGs, MRI, devices, equipment, computer programs and apps on people to collect data
- collecting biological samples (anonymous or identifiable) such as cells, blood, urine & sweat
- receiving biological samples from other researchers (anonymous or identifiable)
- using protected databases and data where you must apply for access or permission
- using protected or confidential reports and information where you must apply for access or permission

Credit: Regan Mandryk

Facebook Emotional Manipulation Experiment

- For one week, Facebook ran controlled experiments that used content filtering to make some users' feeds more positive and some users's feeds more negative

Facebook manipulates users all the time through algorithmic filtering…

…but does this make this experiment OK?

In general, companies' human subjects research does not require IRB.

This case is nuanced: two researchers were professors at Cornell

SEE CORRECTION FOR THIS ARTICLE

SEE EDITORIAL EXPRESSION OF CONCERN FOR THIS ARTICLE

Experimental evidence of massive-scale emotional contagion through social networks

Adam D. I. Kramer[a,1], Jamie E. Guillory[b,2], and Jeffrey T. Hancock[b,c]

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Edited by Susan T. Fiske, Princeton University, Princeton, NJ, and approved March 25, 2014 (received for review October 23, 2013)

Emotional states can be transferred to others via emotional contagion, leading people to experience the same emotions without their awareness. Emotional contagion is well established in laboratory experiments, with people transferring positive and negative emotions to others. Data from a large real-world social network, collected over a 20-y period suggests that longer-lasting moods (e.g., depression, happiness) can be transferred through networks [Fowler JH, Christakis NA (2008) *BMJ* 337:a2338], although the results are controversial. In an experiment with people who use Facebook, we test whether emotional contagion occurs outside of in-person interaction between individuals by reducing the amount of emotional content in the News Feed. When positive

demonstrated that (*i*) emotional contagion occurs via text-based computer-mediated communication (7); (*ii*) contagion of psychological and physiological qualities has been suggested based on correlational data for social networks generally (7, 8); and (*iii*) people's emotional expressions on Facebook predict friends' emotional expressions, even days later (7) (although some shared experiences may in fact last several days). To date, however, there is no experimental evidence that emotions or moods are contagious in the absence of direct interaction between experiencer and target.

On Facebook, people frequently express emotions, which are later seen by their friends via Facebook's "News Feed" product (8). Because people's friends frequently produce much more

Exemptions from human ethics approval

- literature review (published academic articles)
- meta-analysis of published research
- writing a curriculum
- policy analysis, policy report
- writing a training manual using published information
- researching a public figure (e.g. artist, politician, activist) using public documents & published materials
- documenting a community issue using only public documents and information
- observations in public venues without manipulating the context or environment
- viewing movies and works of art
- listening to radio broadcasts and podcasts
- use of purchased anonymous biological samples from a commercial vendor
- social media: online posts from websites and online groups that do not require a log-in, membership, etc.
- these types of sites are publicly accessible with no reasonable expectation of privacy

Credit: Regan Mandryk

Human Subjects Research

- https://www.uvic.ca/research-services/ethics-and-compliance/human-ethics/index.php
  - Do I need ethics approval?
    - https://www.uvic.ca/research-services/how-do-i/get-ethics-approval/research-with-human-participants/index.php
- CORE-2022 requirement
  - https://www.uvic.ca/research-services/how-do-i/get-ethics-approval/how-to-apply-human-ethics-approval/core-2022/index.php
    - If you are applying for Human Research Ethics approval, you must complete the Course in Research Ethics (CORE-2022) tutorial. Ask your advisor about it.

Credit: Regan Mandryk

Ethics *in* Research

Don’t Fake Data

ANNALS OF INQUIRY

THEY STUDIED DISHONESTY. WAS THEIR WORK A LIE?

Dan Ariely and Francesca Gino became famous for their research into why we bend the truth. Now they’ve both been accused of fabricating data.

By Gideon Lewis-Kraus

September 30, 2023

An observer said, “We were, like, Holy shit, there are two different people independently faking data on the same paper.” Illustration by Bryce Wymer

The New Yorker

Don’t Plagiarize

Fuel 381 (2025) 133529

Contents lists available at ScienceDirect

Fuel

journal homepage: www.elsevier.com/locate/fuel

Full Length Article

Energy, exergy and optimization of a binary hydrogen-power production system with net zero emissions

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ARTICLE INFO

Keywords:
Hydrogen
Electrolyzer
Power production
Integration
Process simulation
Optimization

ABSTRACT

This study investigates a novel dual-generation system producing electricity and hydrogen with zero net carbon emissions, utilizing natural gas, water, and renewable energy. It explores the system integration of a Net Zero Cycle (NZC) oxy-combustion power plant with a renewable-powered hydrogen electrolyzer, eliminating the need for an Air Separation Unit (ASU). Process simulations were conducted using Aspen Plus and Aspen Custom Modeler. Sensitivity analyses and optimization was conducted via Particle Swarm Optimization combined with Latin Hypercube Sampling, and an exergy analysis was performed.

In the linked process, the energy consumption of turbomachinery in the NZC increases by 16.9% due to the need for compressing electrolyzer-produced oxygen to combustion levels. Nevertheless, the net power output of the NZC increases by 17%, mainly due to the elimination of the energy-intensive ASU, increased heat provision by the electrolyzer to the regenerator, and the combustion of hydrogen mixed with the oxygen output. Consequently, the efficiency of the NZC improves from 53.7% to 62.8% with this integration. The research also highlights the electrolyzer’s efficient use of condensed water from the NZC process without the risk of salt precipitation. Sensitivity analyses revealed that the system’s efficiency is predominantly influenced by the electrolyzer’s recirculation molar flow, combustion outlet temperature (COT), turbine outlet pressure (TOP), and combustor outlet pressure (COP), by factors of 1.9%, 1.5%, 0.8%, and 0.7%. The hydrogen-power system achieves a maximum first law efficiency of 68.1%. The research shows that the electrolyzer is the main cause of exergy losses, followed by the combustor at 15.8% and 9.3%, respectively.

1. Introduction

Anthropogenic CO_2 emissions have led to climate change [1], and thus carbon capture and storage (CCS) has emerged as an option for mitigating CO_2 emissions originating from various sources [2]. The three primary CCS methods to mitigate power generation emissions are post-combustion capture, pre-combustion capture, and oxy-fuel combustion. Post-combustion capture involves removing CO_2 from the flue gas after combustion. This method is advantageous as it requires minimal modifications to existing combustion processes, making it suitable for near-term implementation in new and existing power plants [3]. Numerous modifications have been applied to post-combustion carbon capture configurations; however, these methods require relatively high energy [4]. For instance, monoethanolamine based CO_2 capture processes in natural gas combined cycle power plants result in an efficiency penalty ranging between 7–13 % and an increased cost of electricity production [5,6]. In pre-combustion capture, the fuel is first gasified, followed by the water–gas shift reaction to produce a mixture of CO_2 and hydrogen, with the CO_2 being removed before combustion of the hydrogen [7]. Consequently, pre-combustion capture finds predominant application in coal gasification processes [8]. A notable downside of pre-combustion carbon capture is its complexity and high cost, particularly when applied to coal-based power plants. This method is less competitive than post-combustion carbon capture [9]. Oxy-fuel combustion, on the other hand, uses oxygen instead of air for combustion, leading to a flue gas primarily consisting of pure CO_2, which is more amenable to storage. This method can be applied with slight modifications to existing power plants and is emerging as a promising carbon capture technology due to its high efficiency and CO_2 concentration in the exhaust gases [10]. Oxygen-combustion cycles exhibit advantages encompassing complete carbon capture and enhanced efficiency in the generation of electricity [11,12].

Hydrogen is considered as an environmentally friendly fuel to

Journal of Power Sources 656 (2025) 238062

Contents lists available at ScienceDirect

Journal of Power Sources

journal homepage: www.elsevier.com/locate/jpowsour

Hydrogen and power generation system with zero emissions from renewable resources: An exergy, energy, sensitivity and optimization analysis

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HIGHLIGHTS

- Producing H_2 and power with zero carbon using a renewable NZC-electrolyzer system
- Integration boosts overall system efficiency from 53.67 % up to 67.08 %.
- Electrolyzer oxygen removes the need for an energy-heavy air separation process.
- Heat and water recycling improves system efficiency and reduces desalination load.
- Sensitivity and exergy show key roles of combustor temp and flow to electrolyzer.

ARTICLE INFO

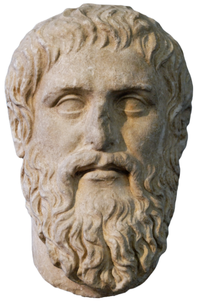
Keywords:
Hydrogen generation
Electrolyser
Net zero cycle
Exergy
Optimization
Air separation unit

ABSTRACT

In this ... examines a new type of co-production system that utilizes a renewable-powered alkaline elec...zer an... Net Zer...cycle (NZC) oxy-combustion power plant to produce hydrogen and electricity s...neously ...ulting in z...o net carbon emissions. The goal of this research is to reduce the energy-intensive Air ... ...y improving overall efficiency through the recovery of system heat and the utilization of oxy... ...nerated by electrolyzers for combustion. Aspen Plus and Aspen Custom Modeller are utilized for system mo...g. Sensitivity analysis is supported by Latin Hypercube Sampling (LHS), and operational conditions are opt...d using Particle Swarm Optimization (PSO). The results demonstrate that the NZC efficiency is ...creased from 53.67 % to 62.9 % upon electrolyzer incorporation and that a peak efficiency of 67.08 % is ...ved through system-wide optimization. By effectively recycling the NZC’s condensed water, the electrolyzer re... the requirement for further desalination while also supplying thermal energy and oxygen. According to the sensitivity study, the main factors influencing performance are the combustor outlet temperature, electrolyzer recirculation molar flow, and output pressures. The electrolyzer and combustor are identified as the main inefficient components based on the exergy evaluation, which can be used to guide future improvements. According to the study’s findings, this integrated system enhances energy and exergy efficiency, mitigates the negative environmental impacts, and provides a potential pathway for producing sustainable hydrogen and power without relying on air separation based on fossil fuels. The results lend credibility to the concept that the system could be a strong way to decarbonize power-producing infrastructure.

RETRACTED

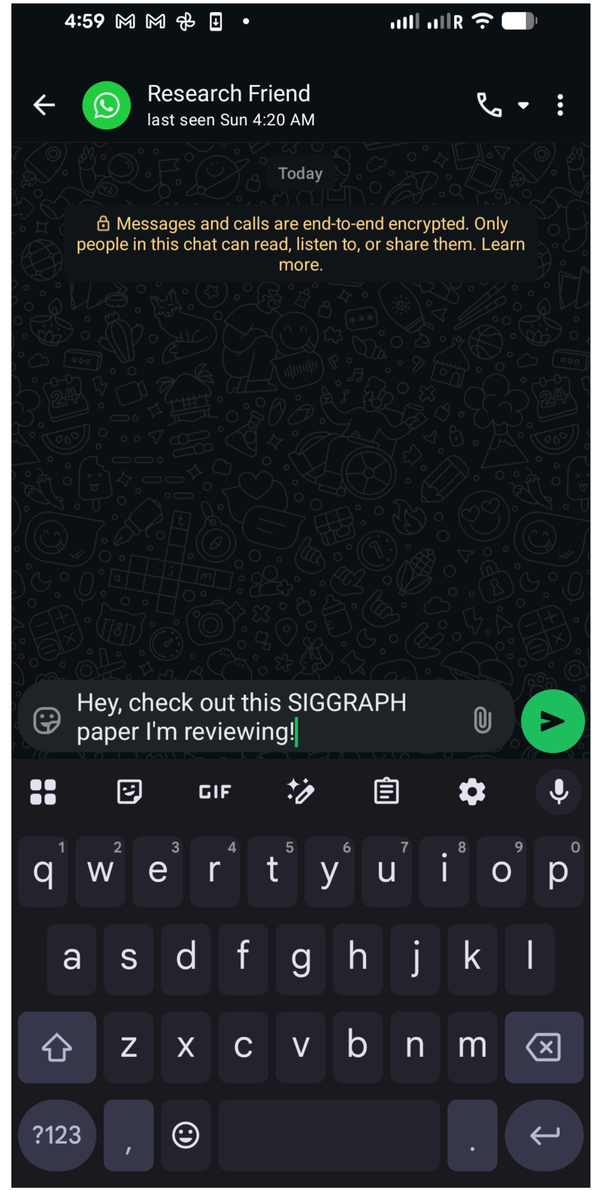
Don’t Steal Ideas



- Plato’s Theory of Forms: Ideas all exist independently of conception in human mind
- “So, if Eva has a major idea and I take this idea for my own work and publish without Eva’s knowledge, what’s the problem?”
  - Research culture is that ideas come from individuals (not like in Plato’s Theory of Forms…)
  - You and Eva belong to same research community. Stealing ideas can harm your reputation
  - If you would like to use the idea and build upon it, let Eva know. Communicate openly

Don’t violate anonymity and confidentiality

- During review process, you gain access to unpublished material
- Essentially all venues (conferences/journals) will ask you not to share this material with others. Read the venue’s policies



Don’t violate anonymity and confidentiality

- Facebook-Cambridge Analytica scandal
  - Cambridge Analytica obtained data from:
    - Facebook users (consented to academic use of data)
    - and their Facebook friends (no consent whatsoever!)
  - Data use far exceeded academic: political campaigns paid for the data
  - Cambridge Analytica has been accused of election interference

Don’t use poor research practices

- For example, don’t do p-hacking

The case of Diederik Stapel

"the biggest con man in academic science"

better to avoid getting this label…

The 20% Statistician

A blog on statistics, methods, philosophy of science, and open science.
Understanding 20% of statistics will improve 80% of your inferences.

Saturday, September 19, 2020

P-hacking and optional stopping have been judged violations of scientific integrity

On July 28, 2020, the first Dutch academic has been judged to have violated the code of conduct for research integrity for *p*-hacking and optional stopping with the aim of improving the chances of obtaining a statistically significant result. I think this is a noteworthy event that marks a turning point in the way the scientific research community interprets research practices that up to a decade ago were widely practiced. The researcher in question violated scientific integrity in several other important ways, including withdrawing blood without ethical consent, and writing grant proposals in which studies and data were presented that had not been performed and collected. But here, I want to focus on the judgment about *p*-hacking and optional stopping.

“According to the CWI, the applicant also acted in violation of scientific integrity by incorrectly using statistical methods (*p*-hacking) by continuously conducting statistical tests during the course of an experiment and by supplementing the research population with the aim of improving the chances of obtaining a statistically significant result.”

Don’t do general bad stuff

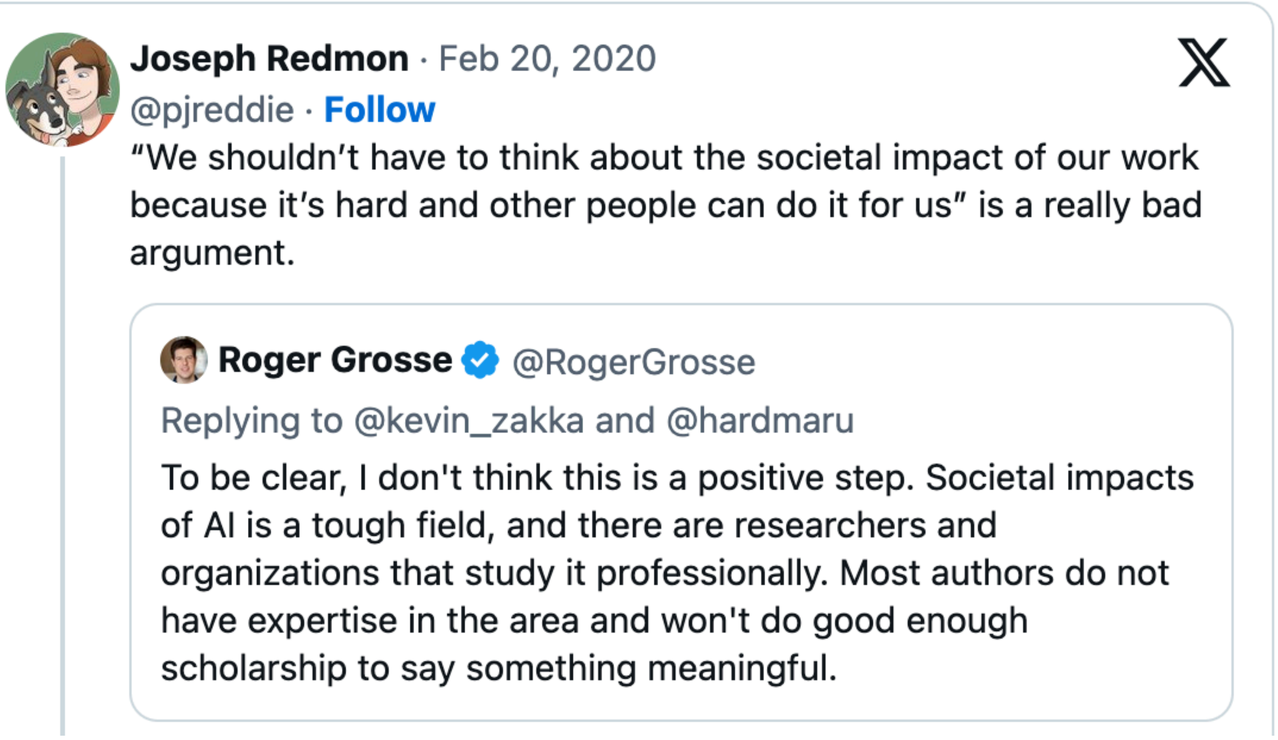
- Examples of general bad stuff:
  - Self-citations even when your papers aren’t that relevant
  - Intentionally not citing others’ work even when it is clearly related
    - This includes not giving credit for:
      - Ideas appearing in other papers
      - Ideas from private communications
- If you have *any* concern something could be bad, ask your advisor!
- If you feel you’ve been asked to do something bad, talk to a trusted third party

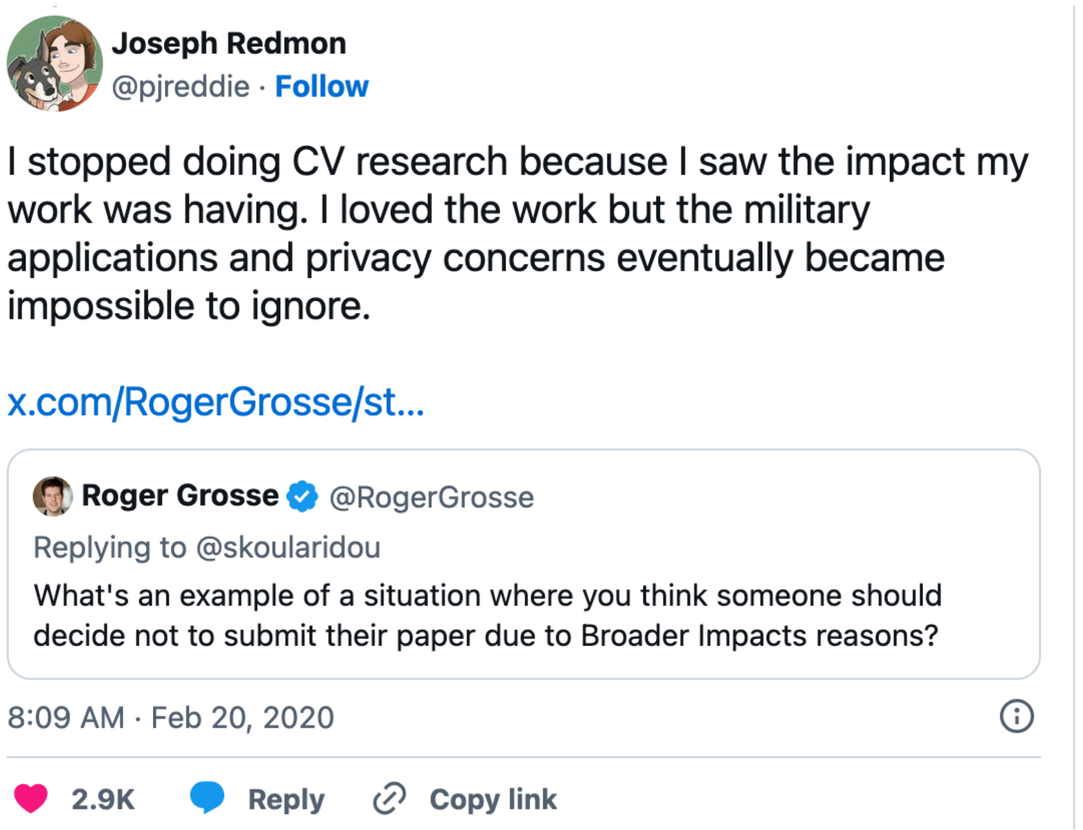
Ethics *of* Research

Joseph Redmon and YOLO

YOLO - You Only Look Once (Redmon et al., 2015) : Computer vision algorithm for object detection

First author Joseph Redmon famously stopped doing computer vision research due to applications





Joseph Redmon and YOLO

Snippet from [arXiv paper for YOLOv3]:

> But maybe a better question is: "What are we going to do with these detectors now that we have them?" A lot of the people doing this research are at Google and Facebook. I guess at least we know the technology is in good hands and definitely won't be used to harvest your personal information and sell it to.... wait, you're saying that's exactly what it will be used for?? Oh.
>
> Well the other people heavily funding vision research are the military and they've never done anything horrible like killing lots of people with new technology oh wait.....[1]
>
> I have a lot of hope that most of the people using computer vision are just doing happy, good stuff with it, like counting the number of zebras in a national park [13], or tracking their cat as it wanders around their house [19]. But computer vision is already being put to questionable use and as researchers we have a responsibility to at least consider the harm our work might be doing and think of ways to mitigate it. We owe the world that much.

Black Mirror Writers’ Room

Black Mirror Writers' Room

https://cfiesler.medium.com/the-black-mirror-writers-room-teaching-technology-ethics-through-speculation-f1a9e2deccf4

Black Mirror, Light Mirror: Teaching Technology Ethics Through Speculation

Even if we can't predict the future, we can use science fiction to think through different possibilities

Casey Fiesler · Follow
9 min read · Oct 15, 2018

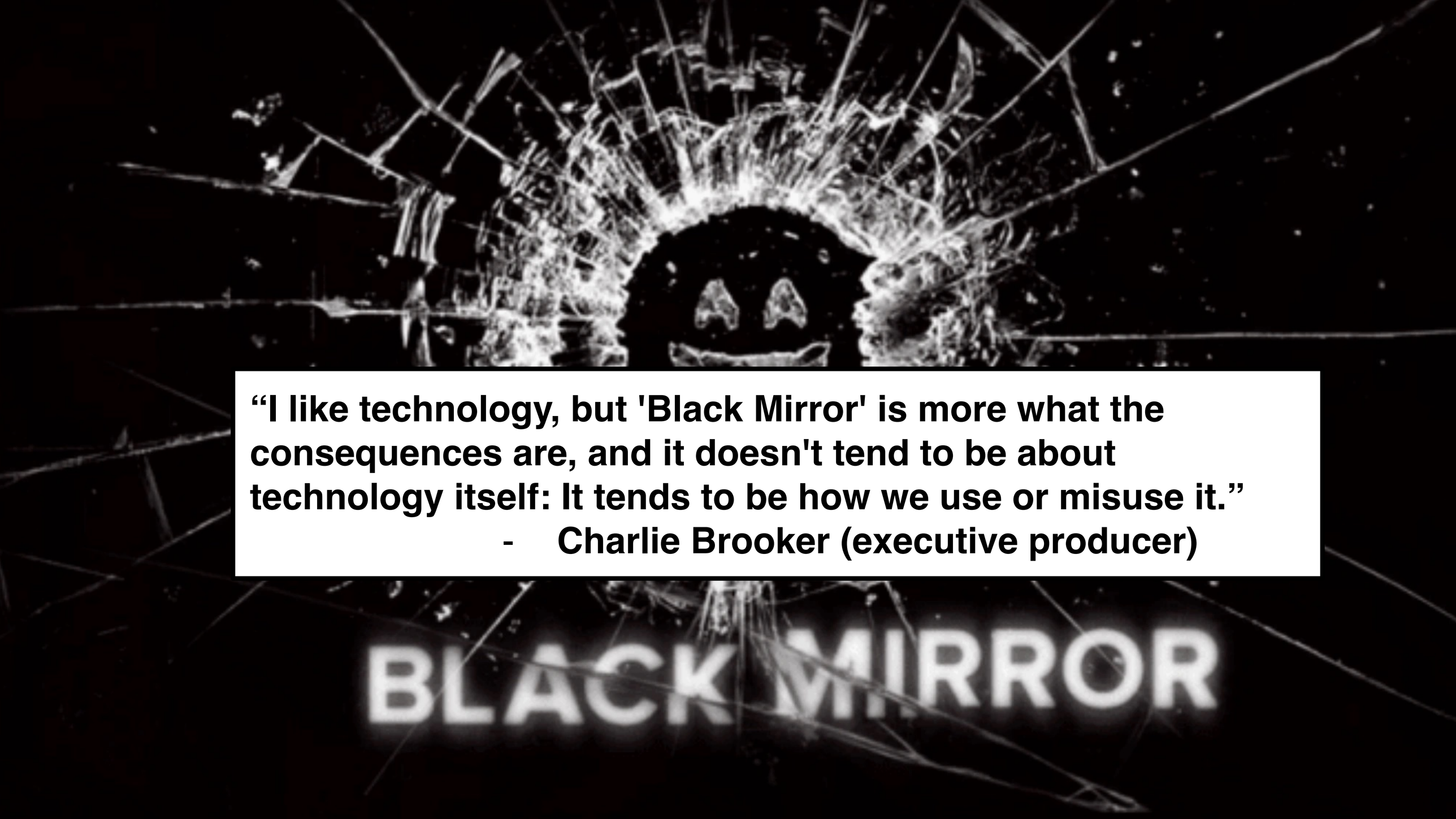
516 5

In "The Entire History of You," anyone with an implant can play back memories directly in front of their eyes.

A reason that *Black Mirror* is so compelling is that it often builds upon our existing anxieties about technology and pushes them just a step further. This is the perfect place to build from when using creative speculation to think through the possible consequences of new technology.

Credit: Casey Fiesler

BLACK MIRROR



“I like technology, but 'Black Mirror' is more what the consequences are, and it doesn't tend to be about technology itself: It tends to be how we use or misuse it.”

- Charlie Brooker (executive producer)

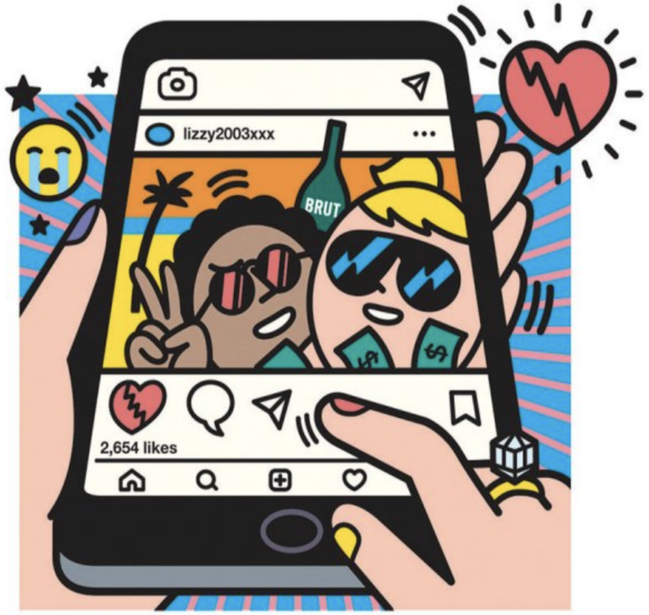
1

Artificial Intelligence Mar 4

China's social credit system stopped millions of people from buying travel tickets

L.A. Kids and Instagram Anxiety: "Social Media Is Destroying Our Lives"

9:45 AM PDT 8/18/2017 by Stephanie Chan



POLICY | US & WORLD | TECH

EU should ban AI-powered citizen scoring and mass surveillance, say experts

New recommendations have also been criticized as lacking enforceability

By James Vincent | Jun 26, 2019, 7:30am EDT

1

NETFLIX ORIGINAL

BLACK MIRROR

2019 TV-MA 5 Seasons

Watch Season 5 Now

"Nosedive"

A woman desperate to boost her social media score hits the jackpot when she's invited to a swanky wedding. But the trip doesn't go as planned.

NEXT EPISODE + MY LIST

Creators: Charlie Brooker

OVERVIEW EPISODES TRAILERS & MORE MORE LIKE THIS DETAILS

2

More parents using GPS to track children but experts warn there could be consequences

By Melanie Vujkovic

Posted 3 Apr 2019, updated 3 Apr 2019

EDUCATION

Privacy Experts Say The Trade-Offs Of Tech To Track Kids In School Aren't Worth It

August 26, 2019 · 4:22 PM ET
Heard on All Things Considered

The New York Times

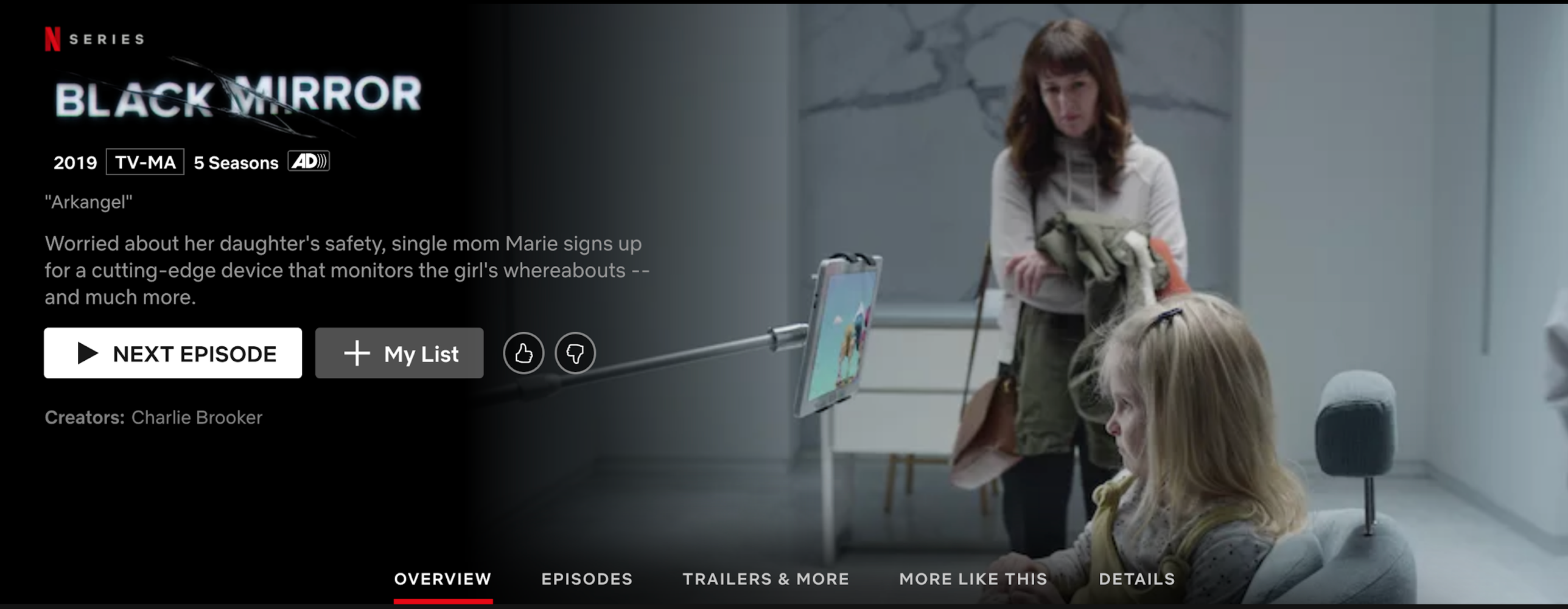
Is Snooping on Teenagers Ever O.K.?

TEEN MONITORING

The Best Teen Monitoring Apps Every Parent Needs

JANUARY 13, 2020 ALEXANDRU TANASE

2


N SERIES
BLACK MIRROR
2019 TV-MA 5 Seasons AD
"Arkangel"
Worried about her daughter's safety, single mom Marie signs up for a cutting-edge device that monitors the girl's whereabouts -- and much more.
NEXT EPISODE
My List
Creators: Charlie Brooker
OVERVIEW
EPISODES
TRAILERS & MORE
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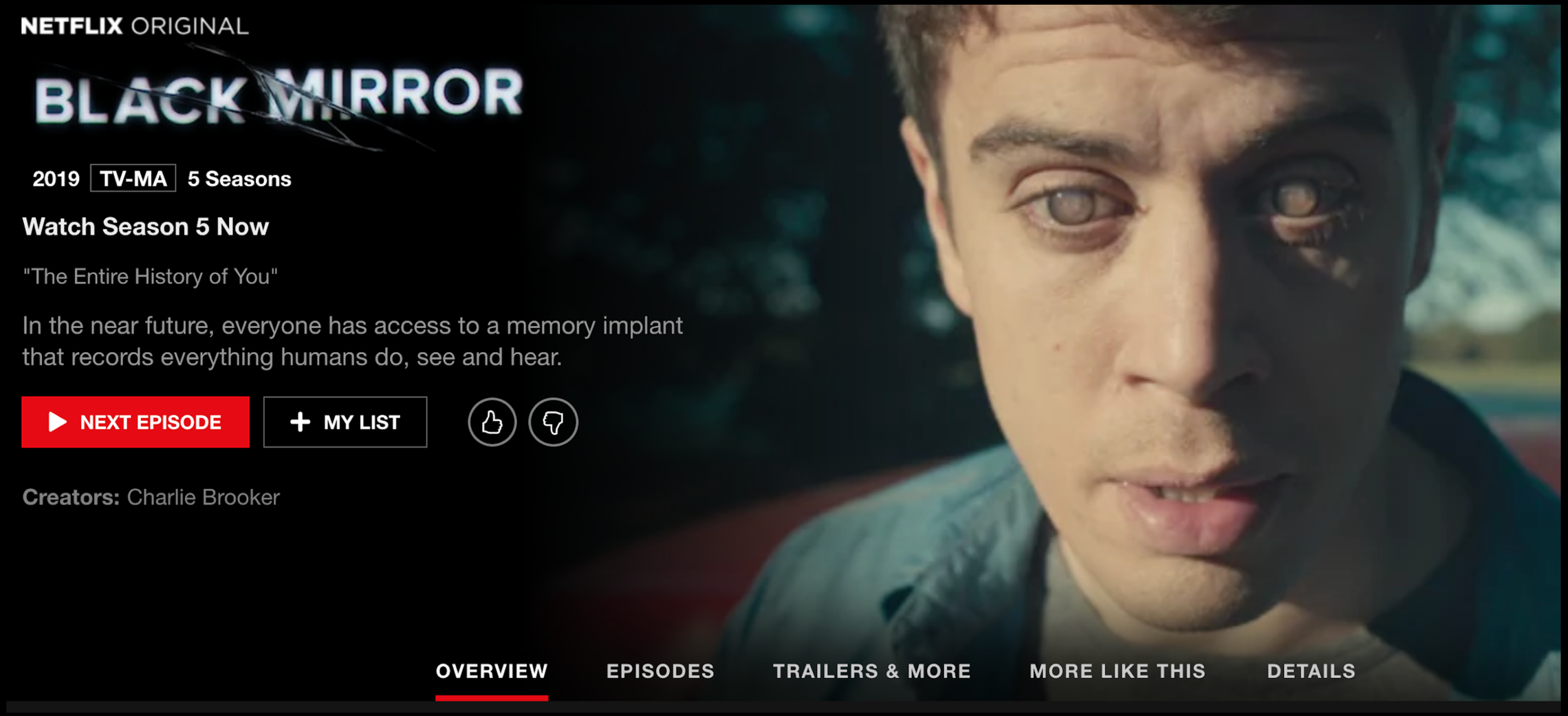
DETAILS

3


NETFLIX ORIGINAL
BLACK MIRROR
2019 TV-MA 5 Seasons
Watch Season 5 Now
"The Entire History of You"
In the near future, everyone has access to a memory implant that records everything humans do, see and hear.
NEXT EPISODE
+ MY LIST
Creators: Charlie Brooker
OVERVIEW
EPISODES
TRAILERS & MORE
MORE LIKE THIS
DETAILS

BRANDS IN CULTURE

‘The situation is the same as it was last year’: Black creators say TikTok’s problems with race and diversity persist

REPORT | TECH | ARTIFICIAL INTELLIGENCE

Transgender YouTubers had their videos grabbed to train facial recognition software

In the race to train AI, researchers are taking data first and asking questions later

By James Vincent | Aug 22, 2017, 10:44am EDT

Instagram apologizes after algorithm promotes harmful diet content to people with eating disorders

A new search feature inadvertently triggered the recommendations

Illinois student moons Zoom class, uses racial slur as learning goes remote

Flawed data is putting people with disabilities at risk

Entry barriers for women are amplified by AI in recruitment algorithms, study finds

Was it ‘techno-racism’? Facial recognition bug denies Black man’s passport photo

bit.ly/blackmirrorwritersroom

(Credit: Casey Fiesler)

01

Brainstorm *near future* technology based on a topic of your choice. It should be close enough that it seems like a plausible future.

02

What are the potential social implications and/or ethical issues and/or regulatory challenges with this technology?

03

What do you think might be a cautionary tale related to this technology?

04

What fictional person in the future would best illustrate this caution?

05

What is their story?

06

What can we do to prevent this from happening?

Credit: Casey Fiesler

01

Brainstorm *near future* technology based on a topic of your choice. It should be close enough that it seems like a plausible future.

02

What are the potential social implications and/or ethical issues and/or regulatory challenges with this technology?

03

What do you think might be a cautionary tale related to this technology?

The original exercise is Steps 1 through 6

Because of time constraints, we will just do Steps 1 through 3

04

What fictional person in the future would best illustrate this caution?

05

What is their story?

06

What can we do to prevent this from happening?

Credit: Casey Fiesler

Example Topics

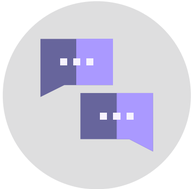
- Algorithmic Bias
- Recommender Systems
- Self-Driving Cars
- Government surveillance
- Censorship
- Free speech
- Internet of things
- Predictive policing
- Facial recognition/analysis
- Social media privacy
- Data privacy
- Online dating
- Robots/AI
- Intellectual property
- Online harassment
- Fake news/misinformation
- Job loss due to automation
- The digital divide

Credit: Casey Fiesler

Steps

STEP 1: Individual Brainstorming

Individually, write down ideas related to the topic, especially: (1) current events and news items that seem relevant (can provide links!); (2) things that currently worry you; and (3) where you think this issue might be headed in the future.



STEP 2: Group Discussion

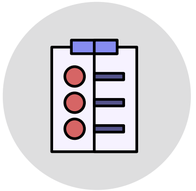
Discuss the individual ideas that each of you had. Settle on an overarching topic/idea for inspiration for a cautionary tale. Note down the kinds of things that are inspiring you (news stories, or things you think are recent *might-have-been* news stories)

Credit: Casey Fiesler. Revised by NM

Steps

STEP 3: Come up with a Story

Think about the thing you want to create a cautionary tale about. What fictional person in the future could help illustrate this caution? What is their story?



STEP 4: Create Your Episode Pitch

Come up with a title, and condense your story into 50-100 word blurb, similar to the examples you saw. It's fine to give away the ending!

Credit: Casey Fiesler. Revised by NM

We can then discuss

- What are the *immediate* harms/implications/ consequences related to what you came up with?
- What kinds of solutions are there in the immediate for addressing these harms? What else could be done?
- What could we do *now* to ensure that we don't get to kinds of future negative consequences you envisioned?

Credit: Casey Fiesler

Recommended Readings

- Car Wars
  https://doctorow.medium.com/car-wars-a01718a27e9e by Cory Doctorow [audio] https://archive.org/details/CarWars

  The Tuskegee Study
  - https://www.mcgill.ca/oss/article/history/40-years-human-experimentation-america-tuskegee-study

- The story of Huxiang Chen
  https://www.sigarch.org/wp-content/uploads/2021/02/JIC-Public-Announcement-Feb-8-2021.pdf (the investigation)
  https://medium.com/@tnvijayk/potential-organized-fraud-in-acm-ieee-computer-architecture-conferences-ccd61169370d

- Collusion Rings Threaten the Integrity of Computer Science Research
  https://cacm.acm.org/opinion/collusion-rings-threaten-the-integrity-of-computer-science-research/

- RetractionWatch
  https://retractionwatch.com

- ACM Policies
  https://www.acm.org/publications/policies

(Credit: Neil Ernst. Revised by NM)