



Unconscious Bias in Data Science

Dr. Sarah Egan Warren, Dr. Aric LaBarr
Feb 23 & 26, 2024

Start with Check In
*Link in Moodle AA 505

**“If you wanna do data science,
learn about cognitive biases,
our alarming lack of statistical
intuition, and how to correct for
them.”**

~ Hugo Bowne-Anderson, Head of Data Science Evangelism and Marketing at Coiled

Agenda for Unconscious Bias Workshop

Part 1: Feb 23

- Introduction
- Revisit Frameworks
- Assignment
- Questions

Part 2: Feb 26

- What is unconscious bias and how does it relate to data science?
- Historical and not-so-historical perspectives
- Navigating difficult conversations
- Introduction for workshop
- Workshop with assigned team
- Reconvene and reflect

Bias and Ethics in MSA Curriculum

- Introduction to Technical Communication class
- Five Steps to Take as an Anti-Racist Data Scientist
- Princeton Dialogues on AI and Ethics Case Studies
- Responsible Storytelling Strategies Class
- Ethical Considerations for Data Professionals
 - Alumni Videos: Hiwot Tesfaye, Jim Box
 - Guest Speakers: Emily Hadley, Patrick Hall
 - Ethics Repository Contributions
 - One Pager with Practicum Team
- Unconscious Bias workshop

Types of Cognitive Biases

20 COGNITIVE BIASES THAT SCREW UP YOUR DECISIONS

1. Anchoring bias.

People are **over-reliant** on the first piece of information they hear. In a salary negotiation, whoever makes the first offer establishes a range of reasonable possibilities in each person's mind.



2. Availability heuristic.

People **overestimate the importance** of information that is available to them. A person might argue that smoking is not unhealthy because they know someone who lived to 100 and smoked three packs a day.



3. Bandwagon effect.

The probability of one person adopting a belief increases based on the number of people who hold that belief. This is a powerful form of **groupthink** and is reason why meetings are often unproductive.



4. Blind-spot bias.

Failing to recognize your own cognitive biases is a bias in itself. People notice cognitive and motivational biases much more in others than in themselves.



5. Choice-supportive bias.

When you choose something, you tend to feel positive about it, even if that **choice has flaws**. Like how you think your dog is awesome – even if it bites people every once in a while.



6. Clustering illusion.

This is the tendency to **see patterns in random events**. It is key to various gambling fallacies, like the idea that red is more or less likely to turn up on a roulette table after a string of reds.



7. Confirmation bias.

We tend to listen only to information that **confirms our preconceptions** – one of the many reasons it's so hard to have an intelligent conversation about climate change.



8. Conservatism bias.

Where people **favor prior evidence over new evidence** or information that has emerged. People were **slow to accept** that the Earth was round because they maintained their earlier understanding that the planet was flat.



9. Information bias.

The tendency to **seek information when it does not affect action**. More information is not always better. With less information, people can often make more accurate predictions.



10. Ostrich effect.

The decision to **ignore dangerous or negative information** by "burying" one's head in the sand, like an ostrich. Research suggests that investors check the value of their holdings significantly less often during bad markets.



11. Outcome bias.

Judging a decision based on the **outcome** – rather than how exactly the decision was made in the moment. Just because you won a lot in Vegas doesn't mean gambling your money was a smart decision.



12. Overconfidence.

Some of us are **too confident about our abilities**, and this causes us to take greater risks in our daily lives. Experts are more prone to this bias than laypeople, since they are more convinced that they are right.



13. Placebo effect.

When **simply believing** that something will have a certain effect on you causes it to have that effect. In medicine, people given fake pills often experience the same physiological effects as people given the real thing.



14. Pro-innovation bias.

When a proponent of an innovation tends to **overvalue its usefulness** and undervalue its limitations. *Silicon Valley?*



15. Recency.

The tendency to weigh the **latest information** more heavily than older data. Investors often think the market will always look the way it looks today and make unwise decisions.



16. Saliency.

Our tendency to focus on the **most easily recognizable features** of a person or concept. When you think about dying, you might worry about being mauled by a lion, as opposed to what is statistically more likely, like dying in a car accident.



17. Selective perception.

Allowing our expectations to **influence how we perceive** the world. An experiment involving a football game between students from two universities showed that one team saw the opposing team commit more infractions.



18. Stereotyping.

Expecting a group or person to have certain qualities without having real information about the person. It allows us to quickly identify strangers as friends or enemies, but people tend to **overuse and abuse** it.



19. Survivorship bias.

An error that comes from focusing only on surviving examples, causing us to **misjudge a situation**. For instance, we might think that being an entrepreneur is easy because we haven't heard of all those who failed.



20. Zero-risk bias.

Sociologists have found that **we love certainty** – even if it's counterproductive. Eliminating risk entirely means there is no chance of harm being caused.



CALL BACK

Ethical Considerations for Data Professionals class where we examined these.

Selected Biases

- Availability Bias
 - overestimating the importance of convenient information
- Confirmation Bias
 - looking until predetermined assumptions are proven/supported
- Look-ahead Bias
 - assuming that the past predicts the future

Selected Biases

- Sampling Bias
 - using an incomplete training dataset
- Selection Bias
 - using samples that are not representative of population
- Survivorship Bias
 - focusing too much on the “winners”

Automation bias, Observation bias, Omitted variable bias, Recall bias, Recency bias, Reporting bias, Sponsorship bias, ...

Unconscious Bias

Understanding Unconscious Bias: <https://www.youtube.com/watch?v=dVp9Z5k0dEE>

Unconscious Bias at Work - Making the Unconscious Conscious:
https://www.youtube.com/watch?v=NW5s_-NI3JE

Explore on Your Own

- We All Have Implicit Biases. So What Can We Do About It?: Dushaw Hockett
<https://www.youtube.com/watch?v=kKHSJHkPeLY>
- Harvard's Project Implicit: <https://implicit.harvard.edu/implicit/takeatest.html>
 - Concerns about Implicit or Unconscious Bias Training/Workshops:
<https://www.scientificamerican.com/article/the-problem-with-implicit-bias-training/>

The 5 Cs by DJ Patil, Hilary Mason, Mike Loukides

Five framing guidelines to create ethical data products.

CALL BACK

Building your own
Framework for your
Practicum Team...
it's a good time to
revisit & revise

Consent

- Do we have agreement to collect and use the data?
- Can a user opt out?

Clarity

- Is it clear to the user that their data is being collected and used?

Consistency & Trust

- Are data collection and usage being done in a trustworthy way? Predictable? With the best intentions?

Control & Transparency

- Can the user control or change how data are used? Can users change their mind?
- Think about GDPR (General Data Protection Regulations) which regulates providing and removing data at user requests.

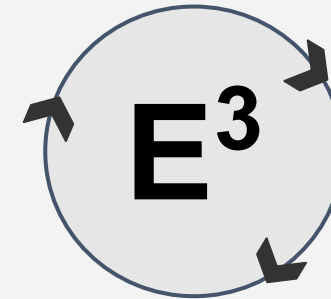
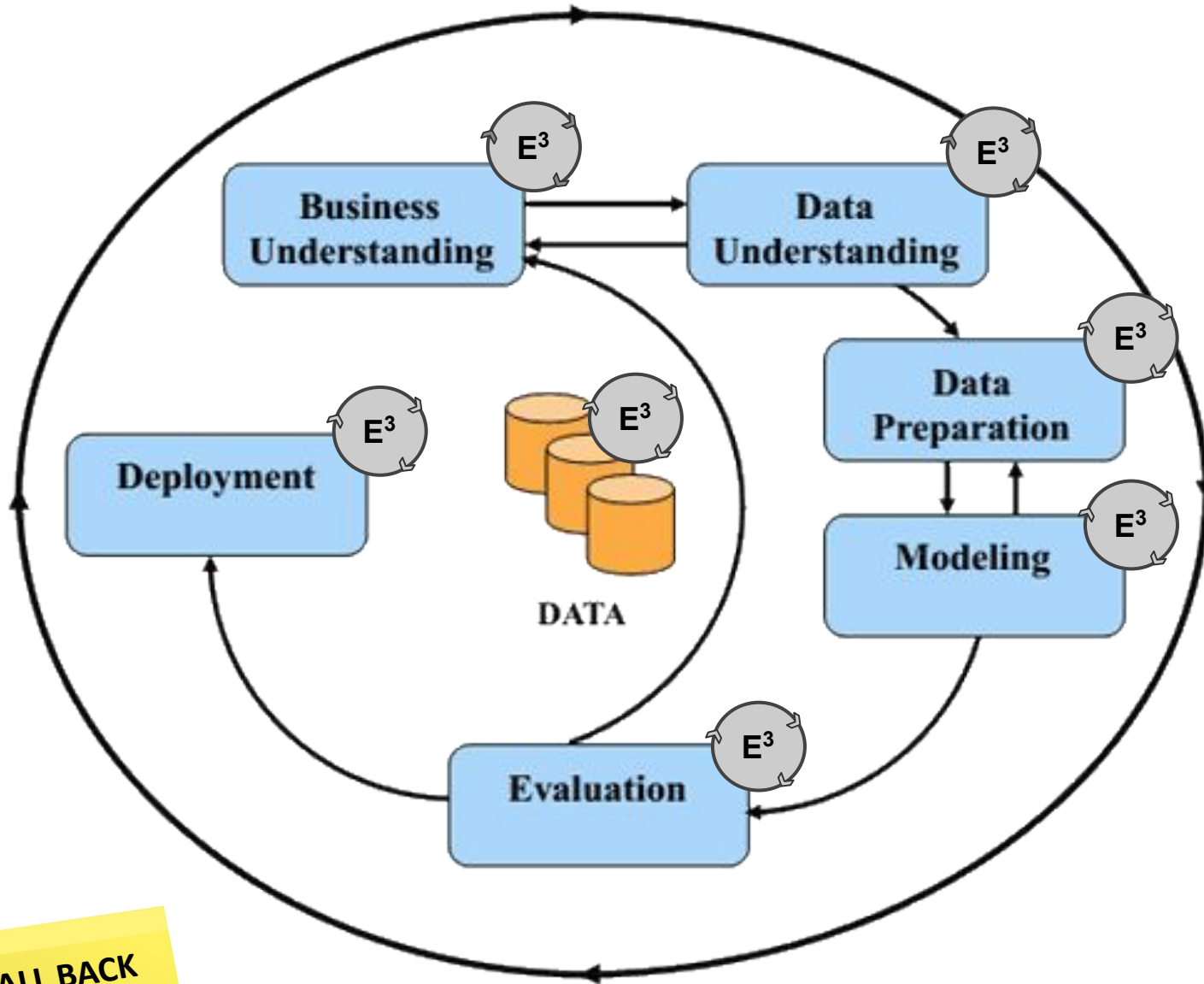
Consequences

- Could the data harm an individual or group?
- What about unforeseen consequences?



CRISP-DM:

Cross-industry standard process for data mining



EXPECTATIONS

- What are your audience's wants and needs?
 - What are your audience's challenges, hot topics, commonalities?

ETHICS*

- How are you using ethos/logos/pathos?
 - How have you considered/addressed bias?

EXPLANATION

- What is the bottom line? / What's in it for them?

CALL BACK

Incorporate ethics into your process.

Navigating <potentially> Difficult Conversations

- Understand that conversations about bias, power, and fair treatment can be challenging
- Be respectful, open, and seek support if you need assistance
- Practice these difficult conversations in a safe space with case studies

PAIRS Framework (Kathy Obear, 2016)

P: Pay attention to the environment and yourself; describe what you notice or engage others based on what you see.

- I'm noticing/wondering _____. Anyone else?
- We appear to have strong feelings on this topic
- It seems you're reacting to what I said

A: ASK about the specifics behind the person's comment or behavior

- Could you say more about that?
- Can you give us an example of what you're saying?
- Help me understand what you meant by that.

I: INTERRUPT any dynamics

- Let's slow down and talk about what just happened...
- May I interrupt and try a different approach to this conversation?
- Let's take a bathroom break and discuss when we get back

PAIRS Framework (Kathy Obear, 2016)

R: RELATE to the person or their comment/behavior

- When I talk to others about this, they have a similar thought
- I remember a time when I did/thought the exact same thing...
- What you're saying seems to relate to what so-and-so just said...

S: SHARE about yourself ~ self-disclose with a story or example; your feelings in the moment; the impact of a comment or behavior, etc.

- When I hear you say that I think/feel....
- I was socialized to believe...
- What I've learned from my experience is...

Take Aways

- No one should be expected to be a spokesperson or teacher on behalf of a larger group of people
- For those identifying with marginalized groups, participate according to your needs and tolerance; for those with privilege, challenge yourself to learn outside your comfort zone.

Activity

1. Read [Generative AI Takes Stereotypes and Bias From Bad to Worse](#)
2. Read your [assigned case](#).
3. Fill out individual [worksheet](#).
4. Be prepared to share with your Practicum Team during Part 2 next week.

OPTIONAL: Meet 30 minutes before class on Monday to talk about your case study with others assigned to the same case.

START WITH
COMMUNICATION
CHECK IN on MOODLE

Agenda Part 2

- What is unconscious bias and how does it relate to data science?
- Historical and not-so-historical perspective
- Preparing for discussion
- Introduction of group exercise
- Reconvene and reflect

What is Bias?

- **Bias** – prejudice in favor of or against one thing, person, or group compared with another usually in a way that is considered unfair.
- Bias can have **negative** or **positive** consequences.

What is Bias?

- **Bias** – prejudice in favor of or against one thing, person, or group compared with another usually in a way that is considered unfair.
- Bias can have **negative** or **positive** consequences.

Rejecting someone for a loan
based on the color of their skin.

What is Bias?

- **Bias** – prejudice in favor of or against one thing, person, or group compared with another usually in a way that is considered unfair.
- Bias can have **negative** or **positive** consequences.

Netflix tailoring their recommended content to you based on your habits.

What is Unconscious Bias?

- **2 Types of Bias:**

1. Conscious (explicit) bias
2. Unconscious (implicit) bias

- **Unconscious Bias** – social stereotypes about certain groups of people that individuals form outside their own conscious awareness.

Microfinance Loans in Developing Nations

- “Trying to improve economies of developing nations at an individual level by using donations to help people start businesses and get out of poverty.”
- Sounds good right? No one would ever complain about that!

Microfinance Loans in Developing Nations

- Typical Conversation:
 - Person A: That sounds amazing! How do you do that?
 - Me: We use microfinance loans. I help the banks who get the donations decide who is best to loan money to based on previous defaults.
 - Person A: HOW DARE YOU! You are trying to put these poor people further into poverty by burdening them with debt!

Microfinance Loans in Developing Nations

- “HOW DARE YOU! You are trying to put these poor people further into poverty by burdening them with debt!”

Microfinance Loans in Developing Nations

- “HOW DARE YOU! You are trying to put these poor people further into poverty by burdening them with debt!”
- Unconscious bias 1: Poor people cannot manage money

Microfinance Loans in Developing Nations

- “HOW DARE YOU! You are trying to put these poor people further into poverty by burdening them with debt!”
- Unconscious bias 1: Poor people cannot manage money
 - Most of these loans have equal if not lower default rates than American small business loans.

Microfinance Loans in Developing Nations

- “HOW DARE YOU! You are trying to put these poor people further into poverty by burdening them with debt!”
- Unconscious bias 2: Everyone has an opportunity to get loans

Microfinance Loans in Developing Nations

- “HOW DARE YOU! You are trying to put these poor people further into poverty by burdening them with debt!”
- Unconscious bias 2: Everyone has an opportunity to get loans
 - Who has been denied for a loan?
 - Who has grown up in a country who doesn't give loans?
 - We live in a society where it is common for people to get loans and so we have a fear of debt.
 - So I should just not give them a chance to get out of poverty?

Microfinance Loans in Developing Nations

- “HOW DARE YOU! You are trying to put these poor people further into poverty by burdening them with debt!”
- Unconscious bias 3: I donate money so everyone must

Microfinance Loans in Developing Nations

- “HOW DARE YOU! You are trying to put these poor people further into poverty by burdening them with debt!”
- Unconscious bias 3: I donate money so everyone must
 - Only 53.1% of Americans (according to surveys) donate money.

Microfinance Loans in Developing Nations

- “HOW DARE YOU! You are trying to put these poor people further into poverty by burdening them with debt!”
- Unconscious bias 4: There is plenty of money to go around
 - 1.5 million charitable organizations in the US alone.
 - The poorest 10% of American households are richer than 67% of the world population.

Unconscious Bias in Data Science

- Algorithms (good ones at least) do a good job of repeating the patterns in the data back to you!
- But what about that data...?
- **Good** – Netflix quickly learns what I like based on the shows I watch and I look at their recommendations and watch a new movie I like.
- **Bad** – My son uses my Netflix account (always happens) and now I get recommended to watch more Mickey Mouse...

Unconscious Bias in Data Science

- Algorithms (good ones at least) do a good job of repeating the patterns in the data back to you!
- **AWARENESS IS KEY!**
- Is the algorithm biased?
- If no, then is the data biased?

Activity

- Meet with your practicum team in your [assigned room](#)
 - Click on Activity Tab to see which room your practicum team will use.
- Take turns sharing information (from your filled out worksheet) with the rest of the team.
 - See example on next slide.
- Fill out the [Google Sheet](#) with notes about each case **as you discuss** each case.
- Come back to Elm by 11:30.

Example: Case #6 Unicorn Farming

Team: Bagley, Egan Warren, LaBarr, Ladrie, and West

**SEW read case #6 and tells Kate, Dr. LaBarr, Laura, and Dr. West about it.*

Bottom Line: This article looked at the amount of candy distributed at Dr. Healey's unicorn petting farm. Striped unicorns get more candy from small children than polka dot unicorns at Dr. Healey's unicorn farm.

General Details: Data collection concerns. Consent concerns because underage participants. Animal cruelty concerns for painting unicorns. Algorithm not trained on other types of unicorns. Potential bias against polka dot unicorns.

Reflection: Need to make sure our data represents all the unicorns that we are trying to make inferences upon.

Response from Teammates: We want to research the data collection more. How can we mitigate potential bias against polka dot unicorns? Need to know who the stakeholders are. Was there a limit on the number of unicorns? How much candy was available? This reminded us of another case at the cryptid petting zoo.