STA201 Week 4: Biases and Surveys

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January 28, 2019

Last Week

- Logical Fallacies
- Truth Tables
- Pictorial Logic

This Week

1. Cognitive Biases
   - Anchoring
   - Certainty Effect
   - Framing Effect
   - Gambler's Fallacy
2. Surveys
   - Coverage Error
   - Sampling Error
   - Nonresponse Error
   - Questionnaire Design

Cognitive Biases I

- Amos Tversky and Daniel Kahneman performed that same experiment on a group of high school students and published the results in the journal *Science* in 1974
- It demonstrated a specific kind of **cognitive bias** called anchoring

Cognitive Biases II

Definition

A **cognitive bias** is a systematic pattern of erroneous thinking which causes irrational behaviour

- What is *erroneous thinking*?
- What is *irrational behaviour*?
- How does this relate to logic?
- What does the word *bias* mean in this context?

Cognitive Biases III

Definition

A **cognitive bias** is a systematic pattern of erroneous thinking which causes irrational behaviour

- Hundreds of cognitive biases have been identified
- Advertisers and pollsters use cognitive biases to their advantage (especially those in which they can alter your beliefs and affect your decisions)
- Some, such as anchoring, are based on how we perceive numbers
- We will talk about four of these in some detail

Anchoring I

Definition

Anchoring is relying too heavily on some initial piece of information (the *anchor*) to make decisions

Anchoring II

Definition

Anchoring is relying too heavily on some initial piece of information (the *anchor*) to make decisions

- The use of anchors is a very common sales tactic
- *"How do you sell a $2,000 watch? Put it next to a $10,000 watch"*
- Advertisers implant an *initial value* (the *anchor price*) which affects your judgment without you realizing it
- A product is more appealing when its price *seems* to be a "good deal"

Anchoring III

Anchoring IV

- Anchoring bias is difficult to overcome
- Anchors can be *completely arbitrary* and still affect your judgment
- Tversky and Kahneman published other examples in subsequent papers (e.g., UN poll)
- The behavioural economist Dan Ariely also demonstrated many other strange examples (e.g, SSNs)

Certainty Effect I

Definition

The **certainty effect** occurs when people rely too heavily on certainty to make decisions

- Also first described by Tversky and Kahneman
- "We process 100% with less cognitive processing or effort and more intuition"

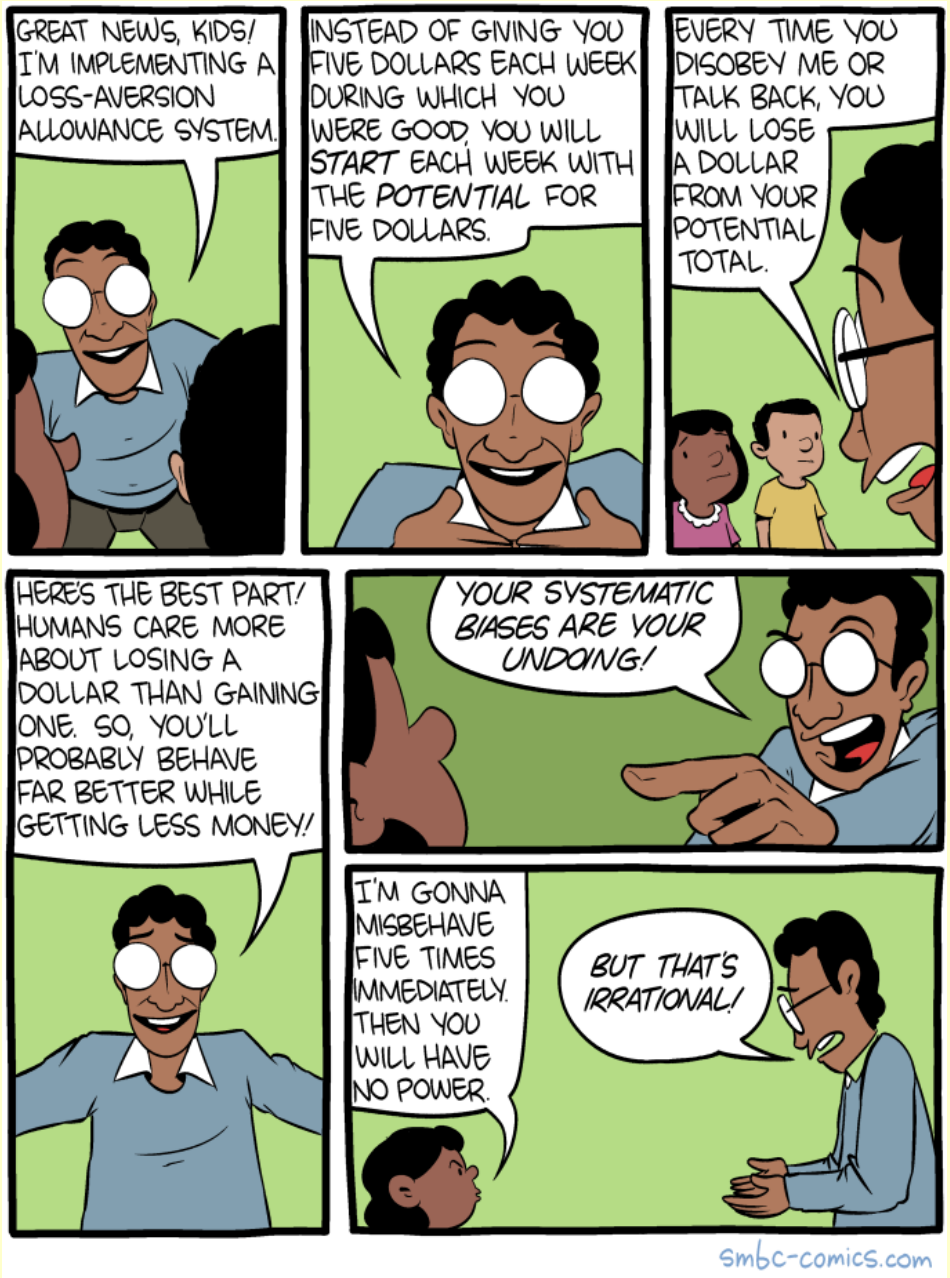
Certainty Effect II

Definition

The **certainty effect** occurs when people rely too heavily on certainty to make decisions

- It goes the other way, too
- Most people have *loss aversion*
- "It is better to not lose $5 than to find $5"

Certainty Effect III



Framing Effect I

- But what if one *particular* outcome is phrased as a loss instead of a gain?

Definition

The **framing effect** occurs when people rely too heavily on the way a choice is presented to make decisions

- Described in 1981... by Tversky and Kahneman
- Did you approve more of the political leader whose decisions caused hundreds of deaths, or the political leader who achieved a higher GDP than any previous administration?

Framing Effect II

- A more realistic example: Tversky and Kahneman's own experiment:

You must choose between administering either Treatment A or Treatment B to 600 people affected by a deadly disease.
Positive framing:

- Treatment A: Saves 200 lives
- Treatment B: A 33% chance of saving all 600 people, 66% possibility of saving no one

Negative framing:

- Treatment A: 400 people will die
- Treatment B: A 33% chance that no people will die, 66% probability that all 600 will die

Framing Effect III

Gambler's Fallacy I

Definition

The **Gambler's Fallacy** occurs when people incorrectly believe that the frequency of past events determines the likelihood of future events

- People commit the Gambler's Fallacy because they do not understand the notion of *statistical independence*
- Informally, two events are independent when the occurrence of one event has no effect on the likelihood of the other event occurring

Gambler's Fallacy II

- What are the events in the coin flip example?
- Are they independent?
- Other examples?

- Is this really a "fallacy"?
- We will make the notion of statistical independence more formal next week

Gambler's Fallacy III

- What if we dropped the assumption that the coin was fair?

Surveys (with lots of Dilbert comics)

Definition

A **(statistical) survey** is a method of making inferences about a population based on questions administered to a sample of individual units

- Surveys are among the most common sources of cognitive bias
- You have likely participated in many surveys in the past (PollEverwhere, for example)
- Surveys are often designed to learn about a population, so the questions are constructed to solicit *unbiased* responses from respondents
- However, when surveys are carried out with errors (intentionally or not), they can lead to *biased* results
- We will discuss several examples of such errors

Coverage Error I

Definition

Coverage error occurs when a pool of possible participants doesn't include some portions of the population of interest

- What if a survey about attitudes to social welfare programs sampled from households with working telephones ($\sim 95\%$ of the population) but excluded the remaining $\sim 5\%$?
- In the same survey, what if landline numbers were sampled exclusively, without cellphone-only users?

Coverage Error II

- Political polls can be particularly susceptible to coverage error...

Coverage Error III

- During the 1948 US Presidential Election, all major polls were using *quota sampling*
- "Quota sampling is nothing more than a systematic effort to force the sample to fit a certain national profile by using quotas: The sample should have so many women, so many men, so many blacks, so many whites, so many under 40, so many over 40 etc. The numbers in each category are taken to represent the same proportions in the sample as are in the electorate at large." (UPenn)
- But as long as they met the quotas, the interviewees could choose whoever they wanted to interview!

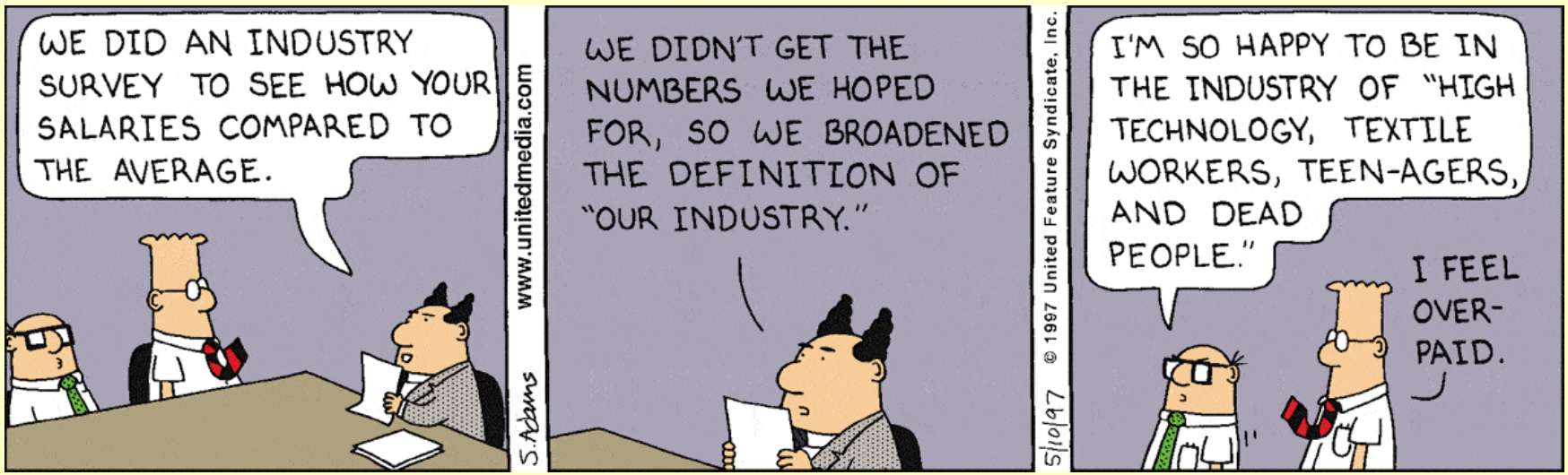
Sampling Error I

Definition

Sampling error occurs due to random differences between a sample and the population under investigation

- If you were trying to gauge whether or not UofT students approve of the new regulation against smoking on campus, would it suffice to ask one student whether or not they supported it?
- Suppose you did, and the student happened to be a smoker who was against the new regulation:
- Or what if you only asked Health Studies majors?
- Tomorrow's (editorialized) headline:

Sampling Error II



Sampling Error III

- Clearly, the more of the population that we (randomly) sample, the less susceptible we are to sampling error
- But sampling is expensive! Especially when we want "clean" data – so there must be a tradeoff between accuracy and cost
- Idea: sample enough people so that the probability that your sample is *not representative of the population* is very low
- How low?

Sampling Error IV

- *The polling reported here was conducted by Innovative Research Group and comes from two sets of data. One survey, conducted April 2 to 9, polled a representative sample of 920 Ontarians from an online pool, weighted to reflect the age, gender and regional makeup of the population. Because the sample was not randomly selected, the pollsters cannot state a margin of error. The other was a telephone poll, conducted March 13 to 20, of 603 people, weighted to reflect age, gender and regional makeup of the population.* ***It has a margin of error of $\pm$4%, 19 times out of 20.*** (CBC)
- In other words:

- Under reasonable statistical assumptions about the population, we can calculate exactly how many people we need
- We will return to this idea over the next few weeks

Nonresponse Error I

Definition

Nonresponse error occurs when the data collection is incomplete

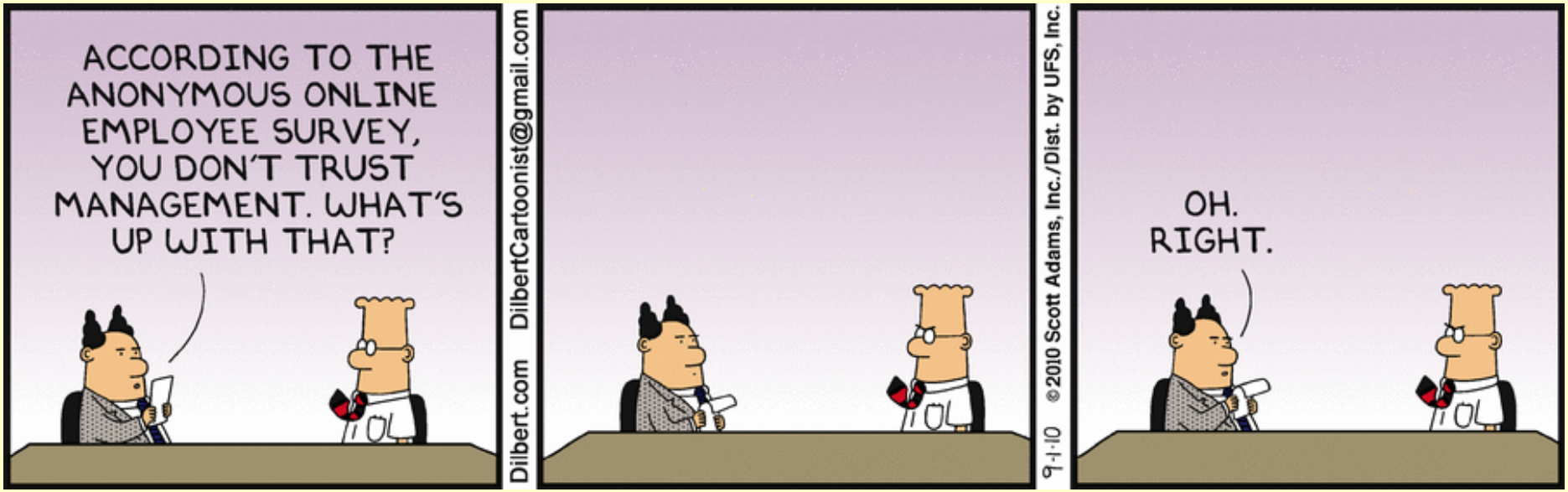
- Are there systematic differences between those who agreed to participate in the survey and those who refused?
- Are there systematic differences between those who answered a particular question and those who skipped the question?
- How can you incentivize people to participate?

Nonresponse Error II

- *Generally, decisions about responding to a poll are not strongly related to partisanship (Pew Research Center 2012). Studies have also shown, however, that adults with lower educational levels (Battaglia, Frankel and Link 2008; Chang and Krosnick 2009; Link et al. 2008) and anti-government views (U.S. Census Bureau 2015) are less likely to take part in surveys. Given the anti-elite themes of the Trump campaign, Trump voters may have been more likely than other voters to refuse survey requests.* (AAPOR)

Nonresponse Error III

- Obviously, respondents should have confidence in the survey methodology to begin with



Questionnaire Design: Open-Ended Questions I

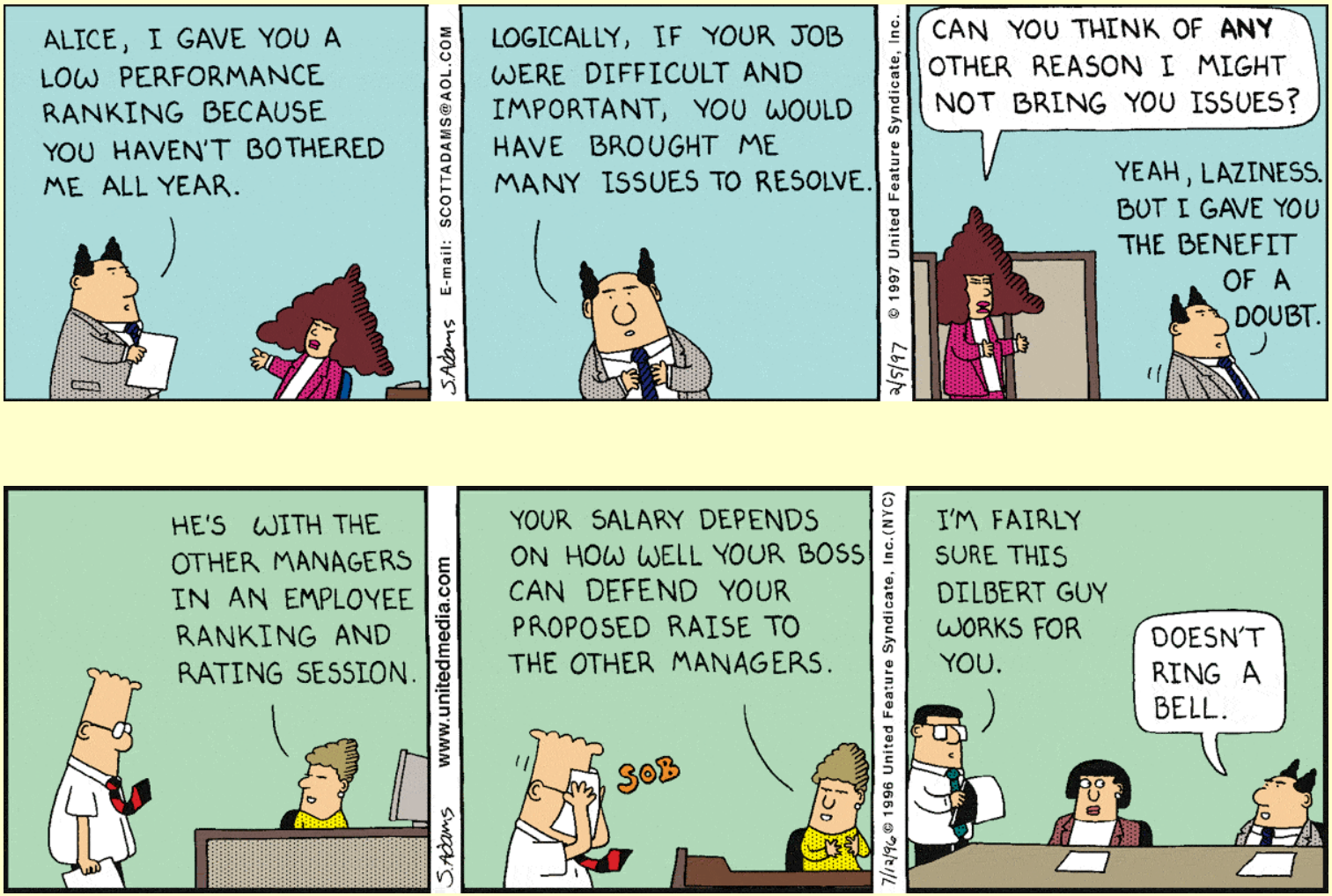
- Should questions be open-ended ("in your own words") versus closed-ended?
- *"What would you do if..."*
- Closed-ended questions may not adequately capture the range of possible responses
- Respondents tend to keep their answers within choices offered, even when "other" is offered – less reliable than open-ended questions
- But how would you "code" open-ended responses (i.e., interpret them and group them into meaningful categories for analysis)?
- What if the respondents' levels of articulateness varied?

Questionnaire Design: Open-Ended Questions II

Questionnaire Design: Rankings Versus Ratings I

- Rating: "On a scale from 1 (poor) to 5 (outstanding), rate the quality of your professors"
- Ranking: "Rank the quality of your professors from worst to best"
- People tend to differentiate their preferences less well with a rating, choosing very similar ratings for different objects
- People tend to avoid choosing extremes
- But people *also* tend to enjoy rating tasks more than ranking tasks
- Forcing people to assign rankings can lead to problems, especially in the workplace

Questionnaire Design: Rankings Versus Ratings II



Questionnaire Design: Question Wording and Choices I

- Please rate your overall opinion of STA201 so far:
  1. Wonderful
  2. Superb
  3. Fantastic
  4. Spectacular
  5. Amazing

- How often do you call your friends using your cellphone?
  1. Never
  2. Rarely
  3. Sometimes
  4. Usually
  5. Always

- "How often do you sleep together?" (1977)

Questionnaire Design: Question Wording and Choices II

- Wording can be ambiguous
- Multiple questions can inadvertently be asked at once
- *"Should parents and teachers teach middle school students about birth control options?"* (opinions regarding parents' versus teachers' roles may differ)
- Recall *framing*: "not allowed" versus "forbidden"
- Ordering of questions: starting with questions that are highly controversial or require much thought or recall of past – respondents more likely to get tired, take shortcuts, misunderstand or misrepresent answers

Questionnaire Design: Question Wording and Choices III

Case Study: 2016 US Presidential Election

- The factors which led to the results of the 2016 US Presidential Election have been the topic of some mild controversy
- Some events legitimately swayed US public opinion leading up to the election
- Even taking those into account, it's a simple fact that almost every reputable political poll conducted prior to the election predicted a Hillary Clinton victory (usually by a wide margin)
- Many of the pollsters committed a range of the simple survey errors we've discussed
- An Evaluation of 2016 Election Polls in the U.S., published last year by the American Association for Public Opinion Research, is a fascinating deep dive into this topic – read or skim through it (it's long) if you're interested