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Bias and Gender Differences

WISE Conference

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1 Introduction

Does identity exist?

Question:

Is personality (e.g. introversion/extroversion, willingness to learn, conscientiousness, etc.)

(A) learned

(B) both

(C) innate

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Personality is a complex interplay of both innate and learned factors.[1]
We distinguish:

[1] Sources: Are You Born with Personality or Does It Develop Later On? – Psych Central, Is Personality Genetic? The Impact of Genes vs. Environment – Verywell Mind, and Acquired vs innate personality traits in the workplace – testgorilla.com

- **Innate Factors**: Some aspects of personality are believed to be innate, often referred to as one's *temperament*. This includes traits that are present from birth, such as energy levels, mood, demeanor, and emotional responsiveness. For instance, some people might naturally be more introverted or extroverted. Twin and adoption studies suggest that human personality is around 30% to 60% heritable.

- **Learned Factors**: Personality is also shaped by our experiences and environment. This includes our upbringing, culture, and unique life experiences. For example, a person's willingness to learn or their level of conscientiousness can be influenced by their environment and experiences.

In summary, while certain aspects of our personality may be determined by our genetics, our experiences and environment also play a crucial role in shaping who we are[1,2,3]. It's a dynamic interplay between nature and nurture[1,2,3].

Gender

Question:

Is gender a social construct?

(A) Yes, that's it definition

(B) No, gender refers to biological aspects

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The word "sex" is the biological concept determined by physical attributes such as chromosomes, hormones, and reproductive organs. The vast majority of humans are born with biological characteristics of sex, either male or female, only 0.018% is intersex.

The term "gender", on the other hand, is nowadays use to refer to the social norms, behaviors, and societal roles typical of individuals based primarily on their sex. Gender identity describes a person's self-perceived gender, which could be male, female, somewhere on a spectrum between those or other variations. About 0.5% of people is not male or female (UK census data).

2 Statistical differences between men and women

The data behind car accidents

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sources: Hailemariam et al., n.d., Eustace and Wei, 2010, Kouabenan et al., 2001, Obeng, 2011, Szumska, Frej, Grabski, et al., 2020, EU, IIHS, NHSA, Insurance information institute, etc.

All agree:

- men cause around 70% of car accidents in the EU
- insurers see around slightly more accidents in female customers, but men have more expensive accidents
- 20,000 male fatalities p.a. vs. 6,000 female in the EU (3 times more men die on the road – 76% of road fatalities are men)[2]
- men are more in fatal accidents (speed and misjudgement), women in minor accidents (distraction, information failure)
- In USA: Men drive ca. 30% more miles than females, and cause 6.1 mln accidents vs females 4.4. (IIHS)

More differences between the sexes

Table 1: USA numbers — sources: www.statistica.com, bubmed.ncbi.mlm.nih.gov, prisonpolicy.com, www.childtrends.org

Topic	Men	Women	Ratio	Percent
school dropouts	7%	5%	1.4	58.3%
road fatalities (EU)	20,000	6,000	3.3	76.9%
suicide (Europe)	22.72 per 100,000	5.68	4.0	80.0%
deaths at work	4,896	437	11.2	91.8%
death in combat	4,226	103	41.0	97.6%
in jail (per 100K)	1,352	126	10.7	91.5%
inmates in death row	2695	55	49	98.0%

Gender stereotypes and bias

	doctor	nurse	police officer
female	45%	90%	17%
male	55%	10%	83%

[2]EU data from: https://ec.europa.eu/transport/road_safety/sites/default/files/pdf/statistics/dacota/bfs2018_gender.pdf

3 What are the reasons for those differences?

To understand the reasons behind these differences, will study personality traits. We start from the Meyers-Briggs type indicators (henceforth MBTI)

The Myers-Briggs Type Indicator is a widely used personality assessment tool that categorizes individuals into one of 16 personality types. The MBTI is based on the theory of psychological types described by Carl Jung.

The MBTI system consists of four preference pairs that reflect different aspects of personality:

A. **Extraversion (E)**or **Introversion (I)**This pair reflects how individuals direct and receive energy.

B. **Sensing (S)**or **Intuition (N)**This pair reflects how individuals take in information.

C. **Thinking (T)**or **Feeling (F)**This pair reflects how individuals come to conclusions.

D. **Judging (J)**or **Perceiving (P)**This pair reflects how individuals approach the outside world[1].

When the letters for each of these preferences are combined, 16 distinct personality types form which consist of different characteristics. Here is a brief description: Sure, here are the descriptions of the 16 MBTI personalities in LaTeX without references:

- **ISTJ**: Quiet, serious, earn success by being thorough and dependable. Practical, matter-of-fact, realistic, and responsible.
- **ISFJ**: Quiet, friendly, responsible, and conscientious. Committed and steady in meeting their obligations.
- **INFJ**: Seek meaning and connection in ideas, relationships, and material possessions. Want to understand what motivates people and are insightful about others.
- **INTJ**: Have original minds and great drive for implementing their ideas and achieving their goals.
- **ISTP**: Tolerant and flexible, quiet observers until a problem appears, then act quickly to find workable solutions.
- **ISFP**: Quiet, friendly, sensitive, and kind. Enjoy the present moment, what's going on around them.
- **INFP**: Idealistic, loyal to their values and to people who are important to them. Want to live a life that is congruent with their values.
- **INTP**: Innovative inventors with an unquenchable thirst for knowledge.

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- **ESTP**: Smart, energetic and very perceptive people, who truly enjoy living on the edge.
- **ESFP**: Spontaneous, energetic and enthusiastic people – life is never boring around them.
- **ENFP**: Enthusiastic, creative and sociable free spirits, who can always find a reason to smile.
- **ENTP**: Smart and curious thinkers who cannot resist an intellectual challenge.
- **ESTJ**: Excellent administrators, unsurpassed at managing things – or people.
- **ESFJ**: Extraordinarily caring, social and popular people, always eager to help.
- **ENFJ**: Charismatic and inspiring leaders, able to mesmerize their listeners.
- **ENTJ**: Bold, imaginative and strong-willed leaders, always finding a way – or making one.

Each of these types has unique characteristics and strengths, and understanding them can provide valuable insights into an individual's behavior and preferences.

You can find more detailed descriptions of all 16 personality types on the official Myers-Briggs website or other resources[3].

Finally, it is important to note that the MBTI is not meant to predict behavior or abilities, but rather to help individuals understand their preferences.

The Gender of Personality: the 16 MBTI personality types

The Gender Differences in the MBTI Dimensions

Table 2: Gender differences in personality. Data from `www.statisticbrain.com/myers-briggs-statistics` and `https://personalitymax.com/personality-types/population-gender/`.

Dimension	Male	Female	Δ
Introversion/Extrav.	5% more Introvert	3% more Extrovert	**8%**
iNtuition/Sensing	22% more Sensing	25% more Sensing	**3%**
Thinking/Feeling	7% more Thinking	26% more Feeling	**33%**
Judging/Perceiving	2% more Judging	7% more Judging	**4%**

[3]For example, you can find more here: Personality Types — 16Personalities, Learn Your MBTI Type What It Means Why It Is Valuable at https://www.myersbriggs.org/my-mbti-personality-type/home.htm?bhcp=1, or Introduction to Type Series — The Myers-Briggs Company.

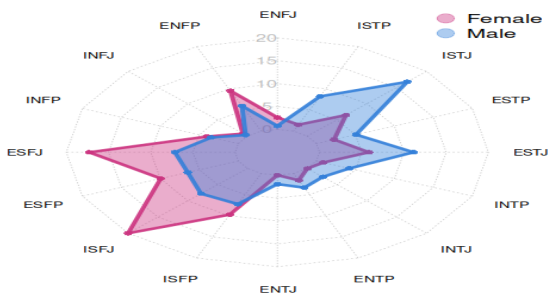

Figure 1: Gender differences in the MBTI profiles.

Sensing/iNtuition and Judging/Perceiving

For the dimensions Sensing/iNtuition and Judging/Perceiving there are on average small differences between men and women, however these differences are so small that we don't seem to notice then and no stereotypes occur in our tales nor customs.

Introversion vs. Extroversion

For the dimension Introversion/Extroversion there is a difference of about 8% between the average score for men and that of women. Figure **??** provides an illustration of what that would mean if the standard deviation is 15% (as we have in IQ). This difference implies that if we select a random pair of a man and a woman in the population that we can expect in 65% of the cases that the woman is more extrovert and the men more introvert in those pairs.

That means that, for example, in marriage (assuming that partner selection is agnostic for introversion/extroversion) in most cases (65%) of the marriages the woman will be more extrovert. This difference seems big enough to be noticed by our pattern-recognising brain, and indeed we see that in many folk tales, the woman is the more talkative person.

Thinking vs. Feeling

When we look at the dichotomy Thinking/Feeling –as illustrated in In Figure 4– we notice that there is a whopping difference of 34% between the average score of both sexes. This implies that (assuming Gaussian distributions and a volatility of 15%) that in a randomly chosen pair of a man and a woman, that in 95% of those pairs the man is more Thinking and the woman more Feeling.

This difference is so big that nearly always men will be more Thinking and woman more Feeling. That means that men will engage first logic and then

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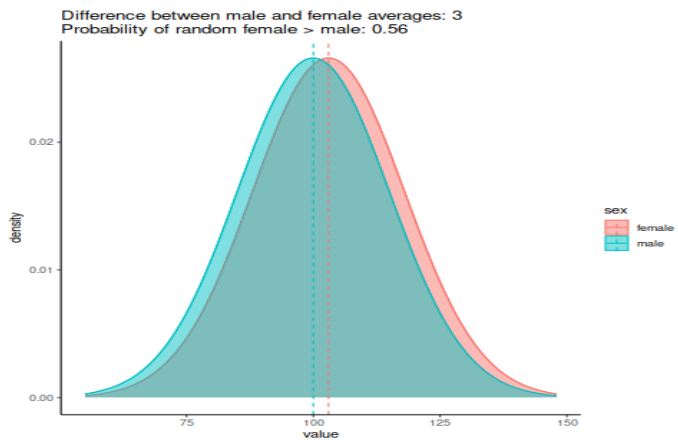

Figure 2: When the differences are small (e.g. 3% or 4%, then the probability that in a random pair men score lower is roughly 50%.

feelings and that the first response is rational, whereas in women we rather expect first the emotional response and then the logical. Both sexes might come to the same conclusion as they both engage both emotional and rational processes, but feelings like satisfaction will rather come from the first reflex.

This seems to be a potential candidate to explain the different career choices mentioned above. Both a nurse and a police officer are linked to hard work that can be dangerous and uncomfortable, but is a first line response to help others. A person who has more a Thinking tendency will get more satisfaction from the police officer role, a person who is more on the iNtuitive side, will get more satisfaction from the nurse role.

This seems to happen only in professions like nurse and police officer: professions that people choose at adult age. If one wishes to become a medical doctor, then conscious hard work need to start at around 13 years old. At that age girls have an intellectual advantage and they are on average more agreeable and hence fit better in the schooling system.

So, we see that when choices are made in adult life gendered roles are preferred, and when parents have more influence we see more equality of representation. Also note that it is likely that the profession of medical doctor does not give a clear satisfaction advantage to one group in the Feeling/Thinking dichotomy.

This is a strong argument against the narrative that people choose for police officer or nurse because of pressure by parents based on stereotypes. Remember, the stereotype about a doctor was male, but the social pressure form parents not.

The Big 5

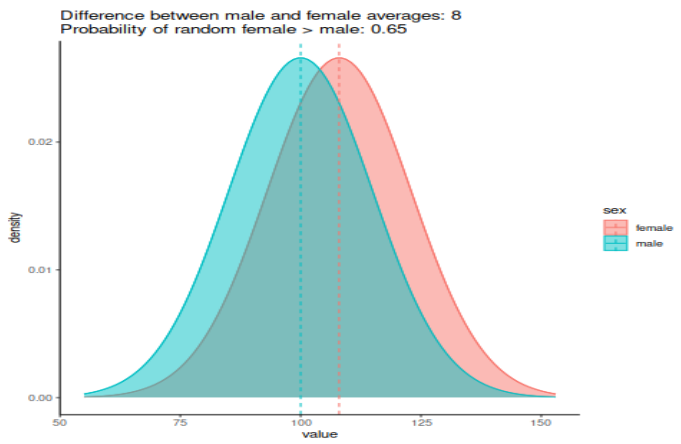

Figure 3: With 8% difference, the probability that in a random pair the woman scores higher/lower is 65%.
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- **Neuroticism** – experience negative emotion in response to perceived threat and punishment (e.g. anxiety, depression, anger, self-consciousness, and emotional lability) — women score higher (except anger)
- **Agreeableness** – cooperation, social harmony, and consideration of others — women score significantly higher
- **Conscientiousness** – self-discipline, organization, and control of impulses (linked to the ability to exert self-control in order to follow rules or maintain goal pursuit) — women score a little higher
- **Extraversion** – sociability, assertiveness, and positive emotionality (linked to sensitivity to rewards) — women score a little higher
- **Openness/Intellect** – imagination, creativity, intellectual curiosity, and appreciation of aesthetic experiences — no diff.

Summary for Personality Types

A. There are significant differences between the sexes on some of the personality dimensions

B. There is overlap on all dimensions (this means that even where stereotypes seem often true, there will always be exceptions)

C. Innate personality exists, learned traits exist too

D. Evolutionary psychology is a compelling explanation for much differences

E. Personality traits correlate to success at work for example

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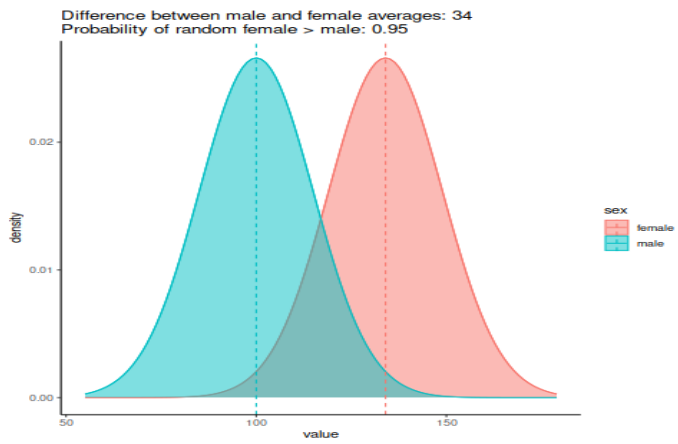


Figure 4: With 34% difference, the probability that in a random pair the woman scores higher is 95% – almost always.

4 Bias

4.1 Visual bias in facial recognition

Figure 5: The Makapansgat Pebble is 2.5 million years old, and might be the oldest evidence of abstract thinking of a humanoid.

4.2 Examples of biases

Bias

source: White paper "Reporting about Diversity and Inclusion that Inspires to Action" by Philippe De Brouwer

- **Overconfidence on own ability and own judgement**: we systematically over-estimate our own abilities (e.g. After the failure of LTCM the owners tried many more hedge funds that equally failed) – typically people use the wording "to be sure" when they are actually 85% sure — See: Camerer and Lovallo, 1999; Daniel, Hirshleifer, and Subrahmanyam, 2001.

- **Framing** we systematically fail to consider problem from multiple points of view (frames), more in particular we tend to focus on a small frame (e.g. profit and loss of an investment) and fail to see the bigger frame (total wealth) — See e.g. Tversky and Kahneman, 1981

- **Confirmation Bias**: we tend to neglect information that dis-confirms our beliefs and overweight information that confirms our beliefs —

- **Information Bias**: the more information we have, the more confident we get; however, in reality too much information is basis for a weaker decision process. This overconfidence translates in believing that we can "win it" and we fail to follow a process —

- **Groupthink**: we have the innate need to conform (e.g. notice how hard it is to remain seated when everyone else is going for a standing ovation), this results in the belief that the majority is right —

- **Shortsighted Shortcuts**: this leads to underestimating the risk of a viral outbreak or interest rates. It also results in trusting that our brain has an unbiased view on the world. Instead our brain will typically use the most readily available information as an anchor and extrapolate from there (but not enough – aka Anchoring) —

- **Attribution Bias and Failure to Seek Feedback**: when a decision is successful then we tend to attribute the success to our own abilities (e.g. "I'm a good investor since the stock that I bought is up") and failures to external circumstances (e.g. "the stock that I bought is down, because of an unfortunate decision of the FED") —

- **Tribal Thinking**: we tend to use ourselves as the norm to judge others and tend to see what our tribe does as normal. An interesting example are the Latin words "dexter", and "barbarus"[4] Obvious examples are wars between tribes, nations, or within nations: almost without exception the rivalling party is portrayed as barbarian.

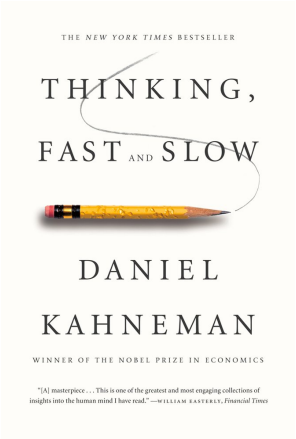
[4]The word "dexter" means left, wrong, unfavorable, on the left hand, perverse, harmful: it was indeed the norm to write with the right hand. Also in English "right" revers to the direction on the right but is also the word to indicate what is fair according to the judicial system. "Barbarus" referred originally to foreigners but soon became a word that indicates uncultivated, savage, uncivilized, wild, cruel, etc.

- **Failure to Learn**: even when we get the feedback, it seems hard to adjust our decision process or understand the biases and heuristics that govern our decision process —

- **Herd behaviour**: our innate drive to conform to the group to which we belong, to fit and to be part of a group (in a way, group-think is a special case of this bias) – Banerjee, 1992; Nosfinger and Sias, 1999

- **In-group favouritism**: related to the previous, and also known as in-group–out-group bias, in-group bias, intergroup bias, or in-group preference, is the bias to favour members of one's in-group over out-group members. This results in an automatic bias for own gender (Rudman and Goodwin, 2004) and race (Fershtman and Gneezy, 2001). We have the tendency to self-identify with groups and favourise members of them in many ways – Oklahoma. Institute of Group Relations and Sherif, 1961; Sumner, 2007

Bias is Rooted in Heuristics for Fast Decisions



Two systems of thinking

System 1

- automatic
- quick
- no sense of voluntary control
- huge processing capacity (11 000 000 bits per second)

System 2

- requires effort and concentration
- slow
- conscious
- limited capacity (40 bits per second)

When we think about "us", we think of System 2, but from others we see more of System 1 (e.g. System 1 is only 7%)

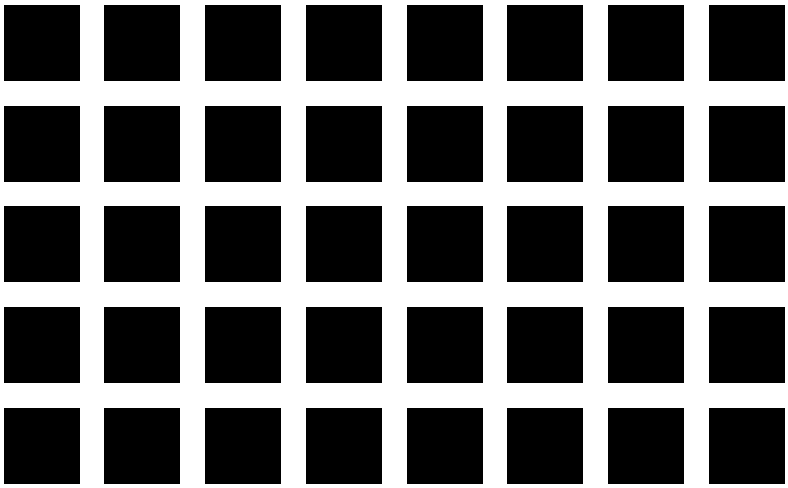


Figure 6: Gray dots appear at the intersection of the black squares (and if you focus on it, then it disappears, but others become visible).

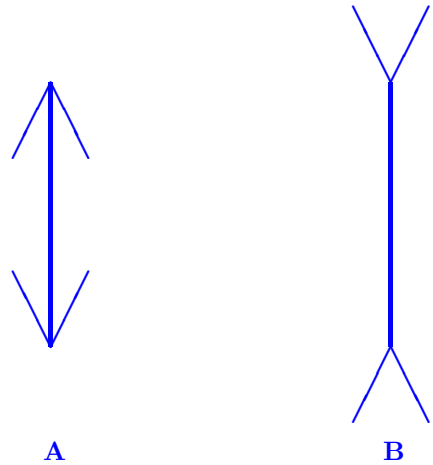


Figure 7: Which vertical line is longer? (only taking into account the vertical lines, not the arrows)

Conclusions for Bias

A. We are all biased in many ways

B. Our brain naturally decides based on bias, when a fast decision is needed

C. We cannot de-bias ourselves completely . . . if at all

5 Recruitment

How to Tame System 1?

Question: – Recruitment

How can we get System 1 under control for recruitment?

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Is this enough to get to equal chances

Question: Assuming that our method is sufficient to tame System 1 in the recruitment process, are the previous rules enough to provide equal and fair chances to everyone?

(A) Yes

(B) No

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Avoid Gender Biased Language

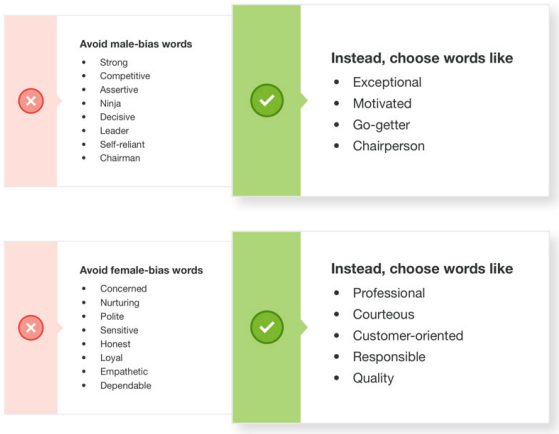

Figure 8: source: https://business.linkedin.com/talent-solutions/blog/job-descriptions/2018/writing-job-descriptions-6-common-mistakes-and-how-to-avoid-them

Conclusions for Recruitment

To counter-act bias, we can:

- Have a process and stick to it
- Select CVs based on quantifiable criteria
- Interview with 2 people (ideally different backgrounds, gender, age, character (MBTI), seniority, ...)

- Decide in advance what questions to ask
- Score answers (from 1 to 5), based on quantifiable aspects of the answer
- Decide on beforehand how you will calculate a total score

6 Beyond Recruitment

Beyond Recruitment

Question:

Is de-biasing recruitment enough to get equal pay for equal work?

(A) Yes

(B) No

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See the paper "Reporting about Diversity and Inclusion that Inspires to Action" – http://www.de-brouwer.com/assets/div/div-white-paper.pdf

Salary and Gender

Question: What mechanisms *can* lead to lower pay for women?

(A) biases like over-confidence, availability heuristic etc

(B) biases like framing, groupthink, in-group favouritism, etc.

(C) prejudice / conscious bias

(D) unconscious bias

(E) all of the above

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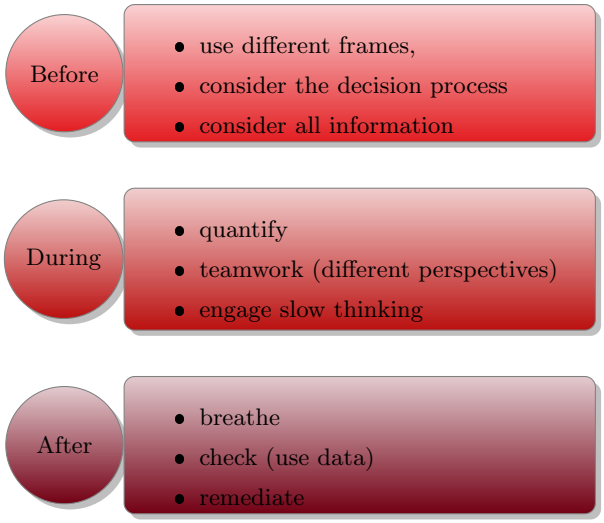
Decision Process



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making paygap actionable

While the phases "before" and "during" making of decisions is well understood and the subject of multiple good books (see e.g. Kahneman, 2011, Russo and Schoemaker, 1989), the search for bias after decision is less understood. Most authors seem to think that it is enough to be aware of bias, have some measures in place such as a quantified decision process in order to make decisions that are not subject to bias. We disagree.

Multiple biases are aligned so that one could reasonably expect women to earn less. For example in-group bias will cause a male manager to intuitively see men in a more favourable light. Since most managers are male, this would lead to some bias.

Even if a manager would be totally devoid of bias, his/her employees are not and systematic differences in character traits between men and women exists. For example –in MBTI terminology– "thinking" people are more comfortable with conflict and confrontation and hence will be more forthcoming in showing disagreement with actual salary and be more prone to negotiate promotion. People that are known to be unhappy with their salary might be faster to get increase. Men score significantly higher on average for this "thinking" dimension and hence that effect will largely work in favour of men.

One will notice that this is in line with the effect of Agreeableness, competitiveness, risk appetite, etc. **All** these differences in traits between men and women will on average work in favour of men to get a relatively higher salary.

Therefore Philippe De Brouwer devised a method and created a software library to analyse salaries and find a level of statistical confidence of bias in salaries. This software library is called "{div}".

The homepage of the library is here:

http://www.de-brouwer.com/div

{div} is a FOSS library to automate beautiful interactive html reports for

- diversity
- inclusion via statistical confidence for bias in pay, and
- make bias actionable:
  - it identifies if a team has bias, and
  - provides priorities of jobs/level combinations that needs most attention
- released under AGPL V3 (so can be modified and used by any private person or company) The library {div} is provided by Philippe De Brouwer free for use and modification

6.1 Measuring Bias via Pay Fairness

Asking the right questions

- **Question**: how can we identify bias in salary?
- **Answer**: the Mann-Whithney U test assigns a confidence level to the question "are those two groups of salaries (M/F) different?"

Using meaningful concepts

- **pay** (total salary or hourly rate) is a good measure (it is quantifiable, reflects reward, etc.)
- let us use the Mann-Whitney U test and see how different salaries of females are compared to others
- let us also calculate a **pay-ratio** (or "paygap" on next slide) = $\frac{salary\ of\ females}{salary\ of\ non-females}$ (helps to see how deep the gap is)
- **postulate**: this pay should be comparable if the job and grade is the same
- *Warning*: this does not allow to use other "acceptable" measures, such as diploma, performance, etc. (if we would do this the sample size gets too small)

Warning

Fabricated and biased data ahead!

- team size: 400
- percentage of females: 0.35
- average male's salary / average female's salary: 1.035

The data on the next pages is randomly generated to conform that built-in bias

Comparing Pay

Action List for seniority/job combinations

grade	jobID	sal_F	sal_oths	n_F	n_oths	paygap	p-value	conf.
0	sales	3,902	4,133	51	105	0.944	0.008647	**
2	sales	17,971	18,737	12	16	0.959	0.000670	***
3	sales	38,154	39,326	1	3	0.970	0.500000	
1	analytics	8,500	8,703	17	24	0.977	0.092868	.
2	analytics	18,022	18,443	4	5	0.977	0.063492	.
0	analytics	4,177	4,229	24	69	0.988	0.396839	
1	sales	8,625	8,712	27	41	0.990	0.349614	
3	analytics	NA	38,825	0	1	NA	NA	NA

Figure 9: A list of actionable pay-levels based on fabricated data.

Illustrating Bias at Aggregate Level

An average pay-ratio different from 1 indicates bias

Other dimensions besides gender

- nationality, ethnicity(+)
- age(*)
- time in company, time in team, time in role(?), time in job level(?)
- diploma(?), school, major, etc.

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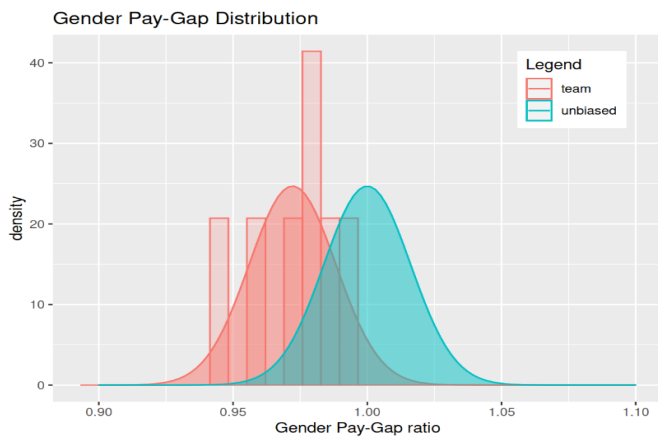

Figure 10: This plot shows that there is a bias against one gender. The histogram (blocks) shows that all pay-ratios are lower than one, and the smooth plot illustrates that by comparing the distribution for the team (red) with an unbiased one (green).

(*) We need to split the *relevant* population in 2 equally sized groups.
(+) If acceptable to ask and collect.
(?) Unless we consider this as an "acceptable" variable.

You probably don't want to use performance – it is *an acceptable parameter* for discrimination – just as grade and job-type.

6.2 Individual Pay Fairness

Asking meaningful questions

- Is the salary of person X fair?
- translation in math-language: is the salary of person X to be considered as an outlier given a model based on all *acceptable* variables
- *Warnings*:
  - What model to use? (linear regression, non-linear regression, decsions tree, neural network, etc.)
  - What is to be considered as an outlier? (2-σ, 3-σ, n-th percentile, etc.)

Individual Pay Fairness

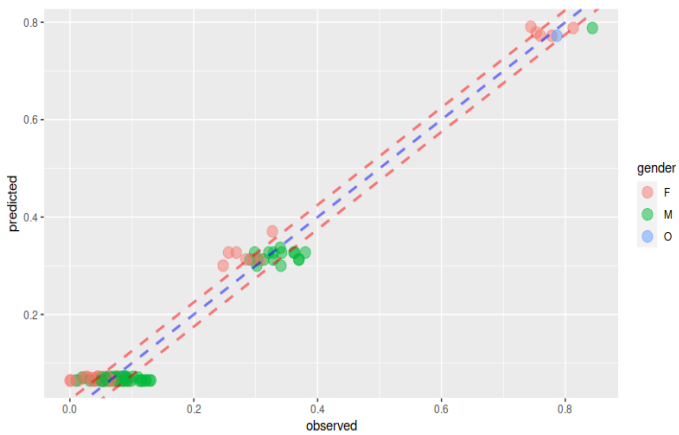

Figure 11: Individual pay fairness is commonly used. One compares salary of individuals with a model that only uses acceptable variables and investigates outliers.

7 Conclusion

Can we learn to de-bias?

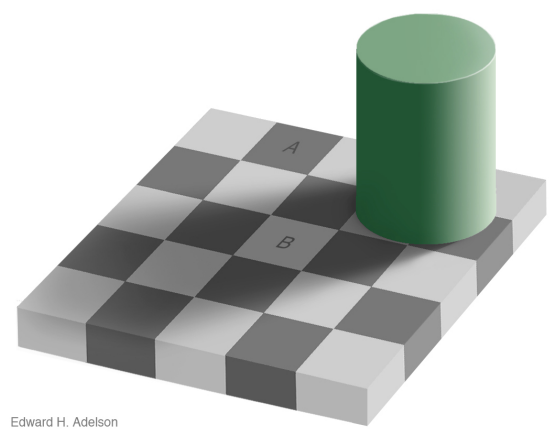

Figure 12: Are A and B of the same shade of grey? – Source: Edward H. Adelson http://web.mit.edu/persci/people/adelson/checkershadow_illusion.html

Conclusions

- We are all biased (bias and shortcuts are the normal mode of our brain)

- We cannot completely avoid bias (even when we consciously try!)
- Men and women have statistically different psychological traits (differences are significant but small enough to allow for exceptions)
- A rigorous process can help to make hiring more objective
- It won't be enough to exclude bias in salaries for example
- Hence, ex-post testing is necessary
- Therefore, managing short lists won't be enough: the heavy lifting of coaching is also necessary; and gendered action is seldom wise (it is double harm for the exceptions).
- Multiple biases pile up against equal pay for women (statistically).
- **Hence, it is necessary to use data and check post decision**
- **especially for salary . . . and we have a free tool for that**
- an unbiased process can still lead to unequal representation (people have preferences)

Suggested Actions

Before
- educate managers about bias,
- have a process

During
- follow the process
- teamwork (different perspectives)
- engage slow thinking

After
- check for bias (use data), e.g. use {div}
- remediate

Always remember

> Everything we hear is an opinion, not a fact. Everything we see is a perspective, not the truth.
>
> Marcus Aurelius , Meditations

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