

BIAS AND ERROR IN HUMANS, AI TECHNOLOGY, AND THEIR INTERACTIONS IN DISTRIBUTED COGNITION

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**BIAS AND ERROR IN HUMANS, AI TECHNOLOGY,
AND THEIR INTERACTIONS IN DISTRIBUTED COGNITION**

good and bad...

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- A huge topic!
- Much to cover
- Today we take a **BIG** first step in this long journey
- Some of it is 'controversial' (e.g., bias, intelligence, performance, errors)
- Going to challenge you
- Before we start... Thank you NIST!

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BIGGER QUESTION...

BIAS AND ERROR IN HUMANS, AI TECHNOLOGY, AND THEIR INTERACTIONS IN DISTRIBUTED COGNITION



← **good**

**When?
Why?
How?**

→ **bad**



BIGGER QUESTION...

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← good

When?

Why?

How?

→ bad



BIAS AND ERROR IN HUMANS, AI TECHNOLOGY, AND THEIR INTERACTIONS IN DISTRIBUTED COGNITION

Will AI solve the problem of bias? ... → NO!

Simple, first, 'take home message'

The Fallacy of “AI/Technological Immunity”

 analytical
chemistry

Available at:

<https://pubs.acs.org/doi/10.1021/acs.analchem.0c00704>

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Perspective

Cognitive and Human Factors in Expert Decision Making:
Six Fallacies and the Eight Sources of Bias

Itiel E. Dror*



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Read Online

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Will AI solve the problem of bias? ... → **NO!**

Yes, some biases will be minimized, even 'disappear'

Some biases will remain,

Some biases will get worse,

Some new forms of bias will emerge.

And... much of it may be 'hidden'.

But, bottom line...:

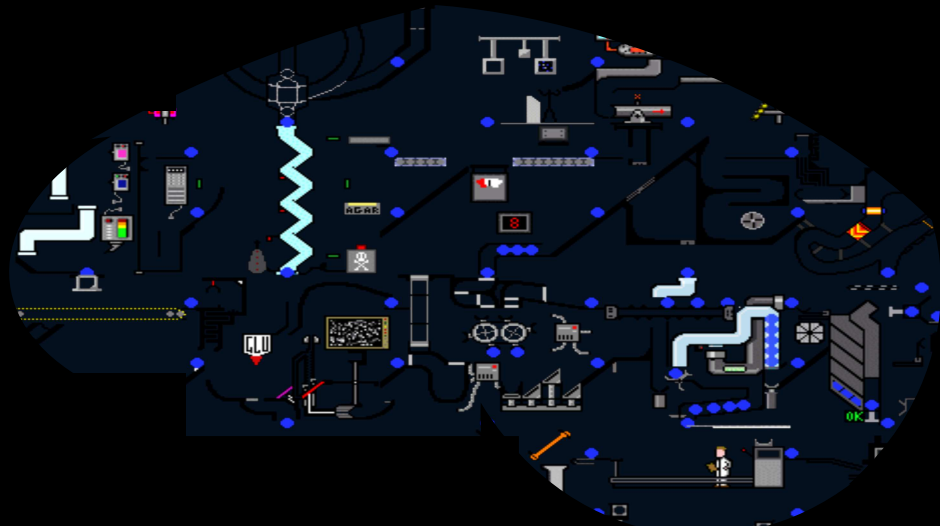
Simple, first, 'take home message'

The Fallacy of "AI/Technological Immunity"

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Dividing the work, cognitive work (AI, ‘cognitive technology’) –think with us, for us.

WHY SMART PEOPLE DO STUPID (BIASED) THINGS
WHY SMART COMPUTERS DO STUPID (BIASED) THINGS



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Dividing the work, cognitive work

→ **Distributed Cognition**

Different levels:

1. 'Off loading'
2. Partnership, collaborating
3. Human is 'subservient'

From 'helping', to 'working with us',
to 'taking over'

(driving, aviation, railway, military,
healthcare, banking, & forensics)

The bias in AI, and how to mitigate it,
depends on the level and nature of the
distributed cognition!

And, on each level, bias can manifest
itself in:

1. The input, what the data are
2. The software itself (human or not)
3. The output (how it is operationalized,
and even what the output is!)

Forensic Fingerprinting

- Highly skilled expertise of comparing a pair of fingermarks (one from the crime scene (a latent print, the unknown) to the known person.
- AFIS (Automated Fingerprint Identification System), searches huge databases.
- This technology is a 'level 2' distributed cognition (a collaborative partnership)
 - A. The latent input to AFIS... human decides what the minutia are (data).
 - B. AFIS can search tens of millions of prints, but cannot determine what is a match → Can only provide a list of most likely candidates to the human, who can make the decision.

Forensic Fingerprinting

- So AFIS provide a ranked ordered list ($n = 10, 15, 20, \dots 50$).
- The vast majority of hits are on the top of the list.
- This creates a base rate bias.
- That means, a bias processing information, as a function of where a fingerprint is on the list:
 - How much time is spent on each item on the list as a function of its position (i.e., identical items).
 - More likely to miss an identification when it appears lower down the list (false negatives).
 - More likely to make an identification error when on candidates at the top of the list (false positives).

An example of distributed cognition

Law, Probability and Risk (2010) 9, 47–57. doi:10.1093/lpr/mgp031
Advance Access publication on January 22, 2010

Available at: <http://www.cci-hq.com/publications.html>

**The use of technology in human expert domains:
challenges and risks arising from the use of automated fingerprint
identification systems in forensic science**

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AND

JENNIFER L. MNOOKIN‡

- So AFIS provide a ranked list of candidates (e.g., 1, 5, 20, ... 50).
- The vast majority of hits are on the top of the list.
- This creates a base rate bias.
- That means, a bias processing information, as a function of where a fingerprint is on the list:

- How much time is spent on each item on the list as a function of its position (i.e., identical items).
- More likely to miss an identification when it appears lower down the list (false negatives).
- More likely to identify when on candidates at the top of the list (positives).

PAPER

GENERAL

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Jeff Walajtys,³ B.A.*

**The Impact of Human–Technology Cooperation
and Distributed Cognition in Forensic Science:
Biasing Effects of AFIS Contextual Information
on Human Experts***

JOURNAL OF
**FORENSIC
SCIENCES**



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good and bad...

Four take away messages...:

1. The Fallacy of AI/Technology Immunity from bias.
2. The bias in AI depends on the level & nature of distributed cognition.
3. AI can cause...: some biases to be minimized, some to remain, some to get worse, and some new forms of bias will emerge (much of it may be 'hidden').
4. These biases are not only in the software (regardless of who wrote it), but also in the input (what the data are), and in the output (how it is operationalized, as well as testing strategies).

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Among other issues I want to talk about (but have no time) are:

1. Trust
2. Vigilance
3. Bias vs. Noise
4. Impact on human intelligence (why AI makes us more stupid)

→Next time! 😊

Thank you very much!

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Questions...???

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