Learning as it happens, learning how it happens

Gunter Maris

A little history of nearly everything

A little theory of nearly everything

Learning as it happens

Learning how it happens

Discussion

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Gunter Maris

CITO - University of Amsterdam

1. A little history of nearly everything
2. A little theory of nearly everything
3. Learning as it happens
4. Learning how it happens
5. Discussion

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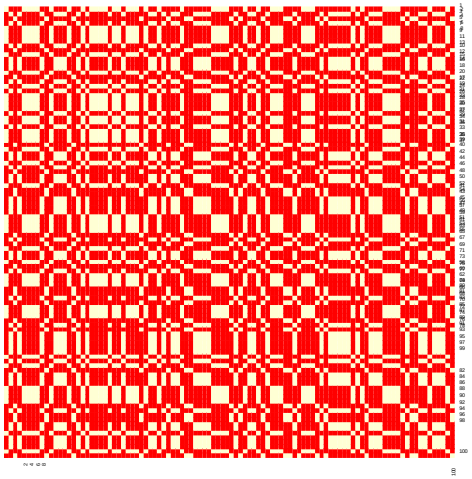
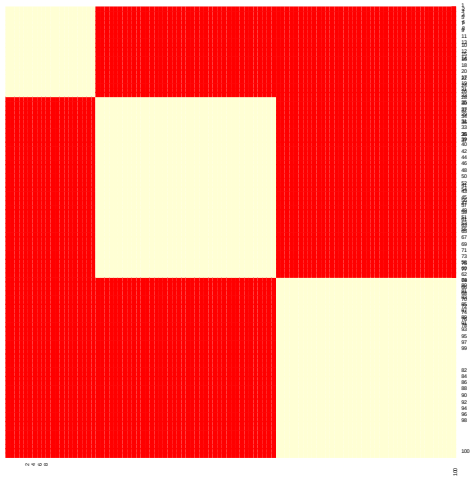
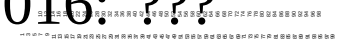
- 1904: Spearman invents factor analysis





$\Leftrightarrow$

- 1904 - 2016: ???



in psychometrics

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what we've learned since 1904:

- positive manifold
- increasing positive manifold
- children learn
- Matthew effect: "the rich get richer, the poor get poorer."
- ...

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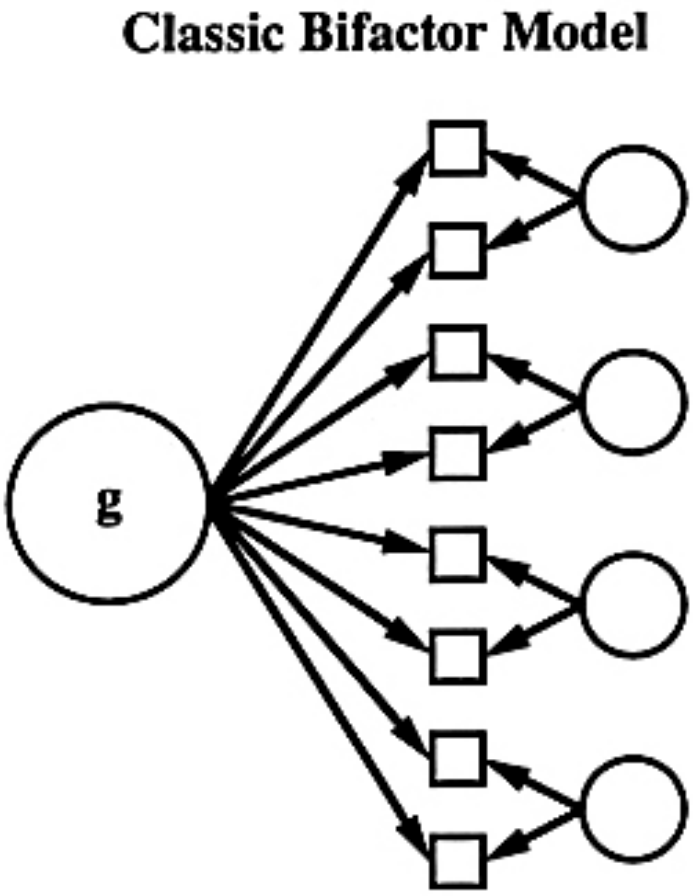

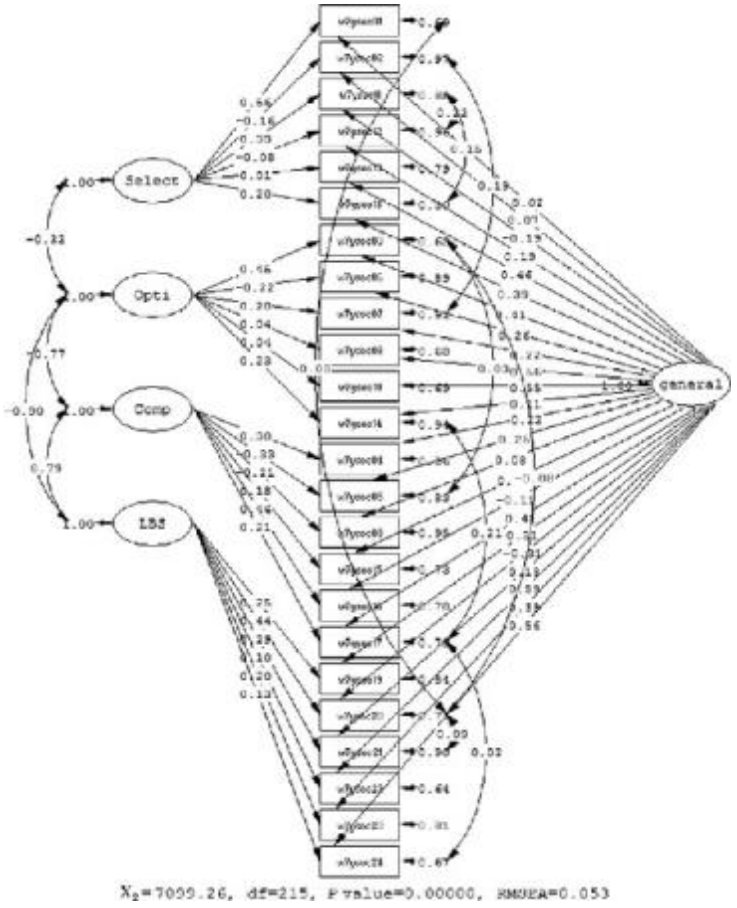

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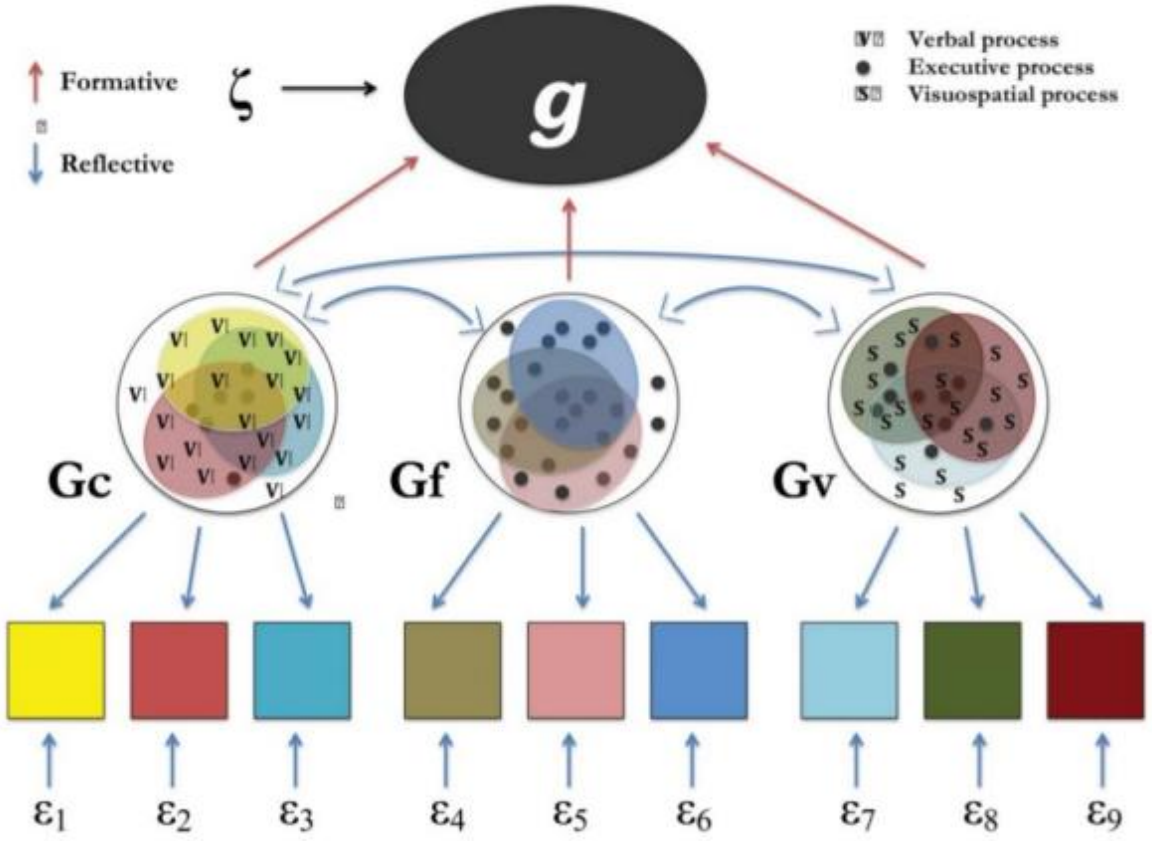

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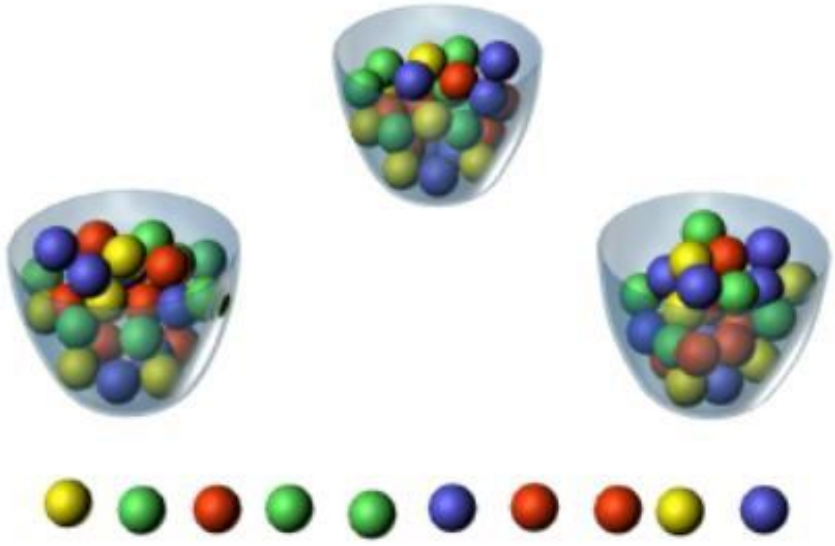
The latent variable perspective:



does not allow for learning!

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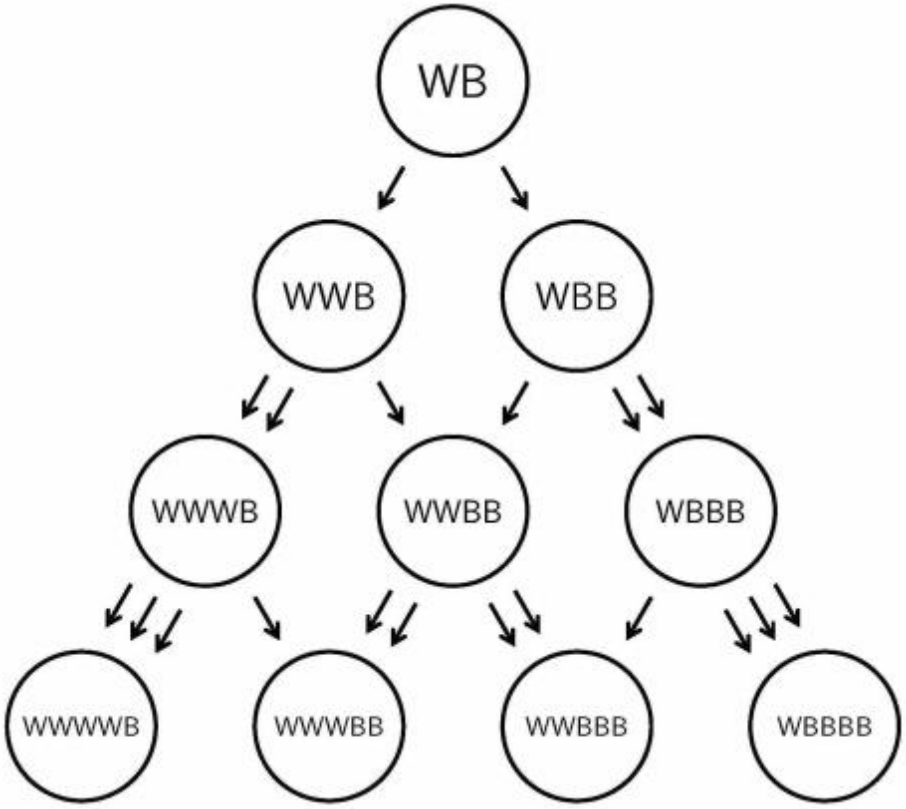
James J. Heckman: 2000 Nobel laureate economics:



challenges this point of view, in a radical way

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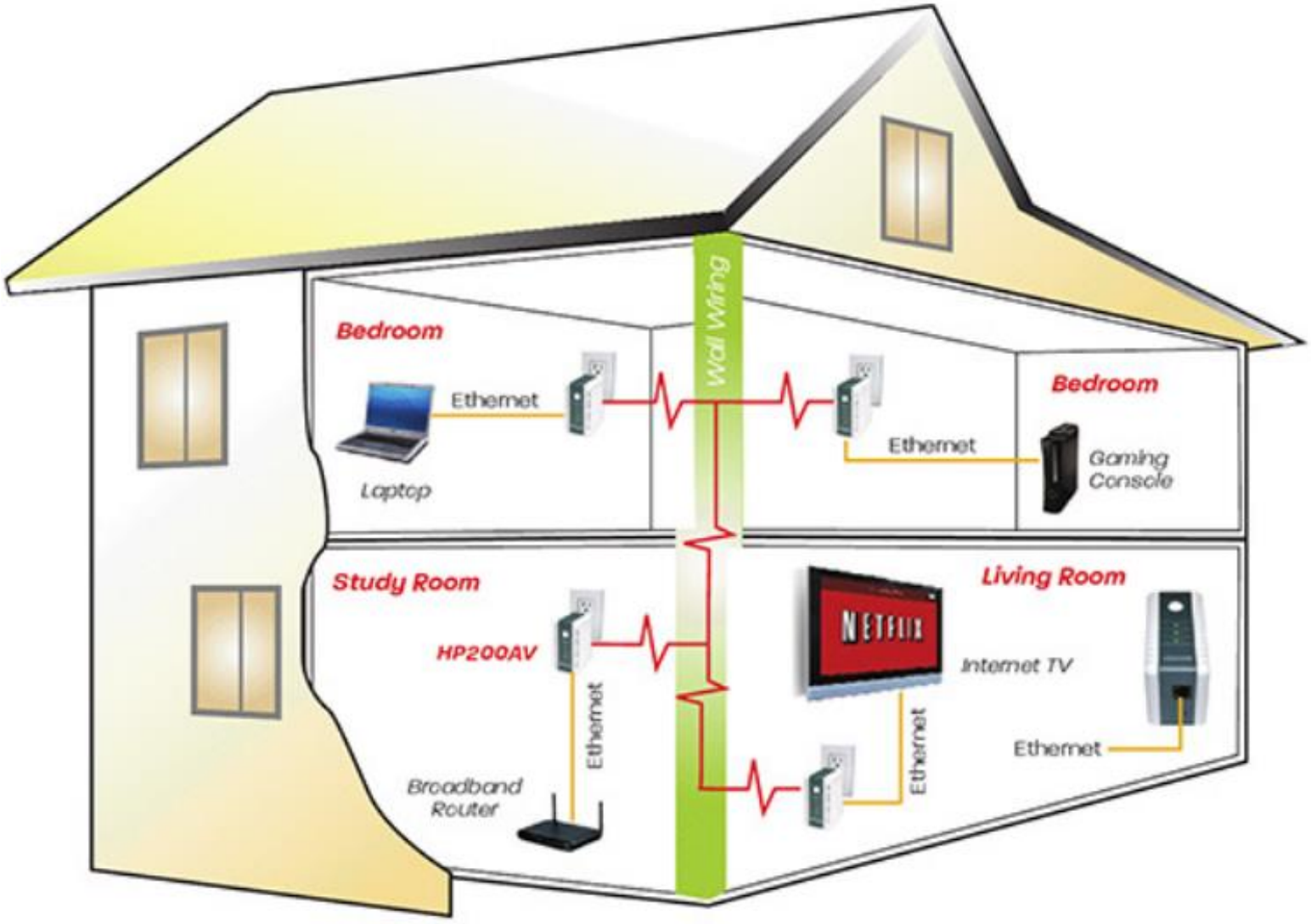
A different point of view: wired cognition



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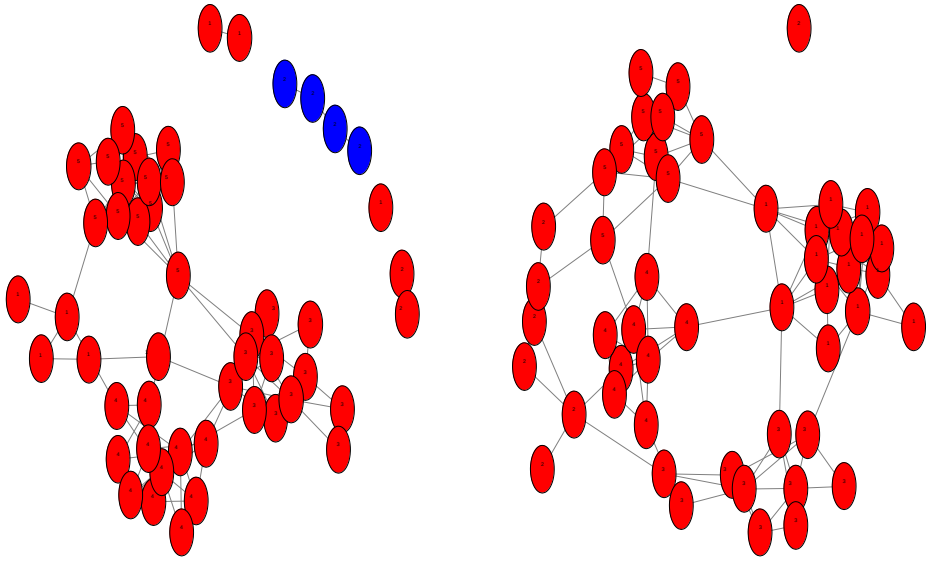
A causal mechanism:

$$(i \underset{E}{\leftrightarrow} j) \Rightarrow (\sigma_i = \sigma_j)$$



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A causal mechanism in reverse:

$$(\sigma_i = \sigma_j) \Rightarrow (i \underset{E}{=} j) \Rightarrow (\omega_{ij} = 0)$$

and a lot more

- $p_E(\sigma_i = \sigma_j) = \frac{1}{2}(1 + p(i \underset{E}{\leftrightarrow} j)) \geq \frac{1}{2}$
- $p_{E \cup D}(\sigma_i = \sigma_j) \geq p_E(\sigma_i = \sigma_j)$
- $\sigma_+ \uparrow$ with time
- ...

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How about learning?

$$p(\omega_{ij} = 1 | \omega_{(ij)}) = \begin{cases} p & \text{if } i \underset{E \setminus \{ij\}}{\leftrightarrow} j \\ \frac{p/2}{1-p+p/2} & \text{if } i \underset{E \setminus \{ij\}}{=} j \end{cases}$$

Thank you

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