PSY 511

# Levels

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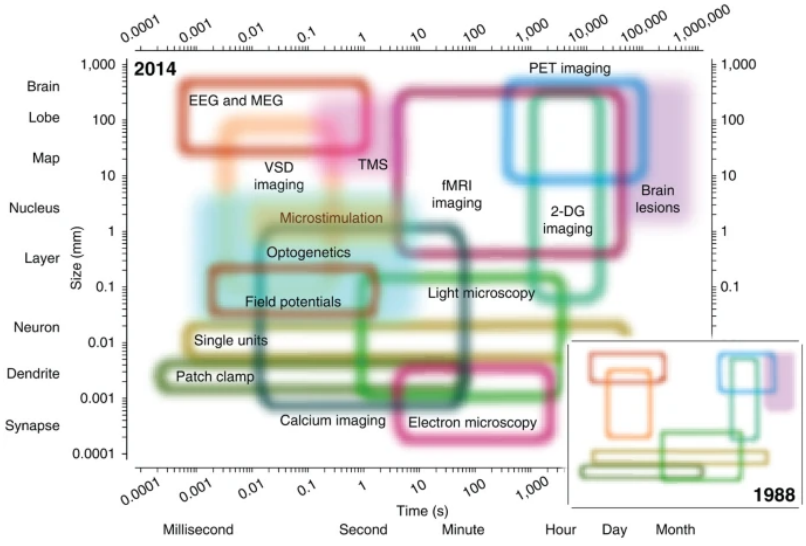
2021-09-01 07:51:03

# Prelude

# Today's topics

- Levels of analysis
- Does neuroscience need behavior? Does behavioral science need the brain?

## Levels of analysis



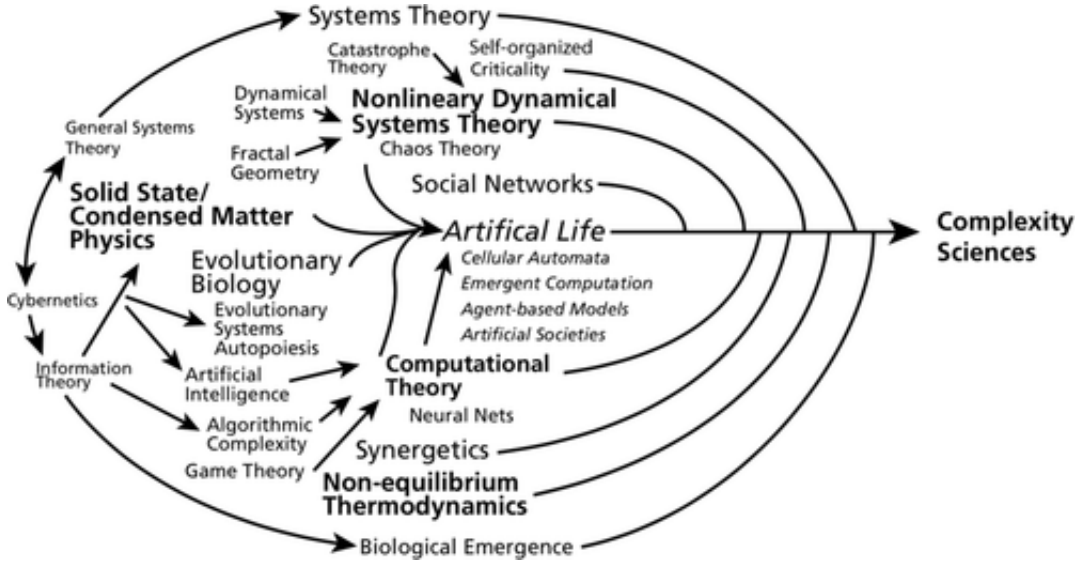

(https://media.springernature.com/lw685/springer-static/image/art%3A10.1038%2Fnn.3839/MediaObjects/41593_2

as=webp)

(Sejnowski, Churchland, & Movshon, 2014)

(http://doi.org/10.1038/nn.3839)

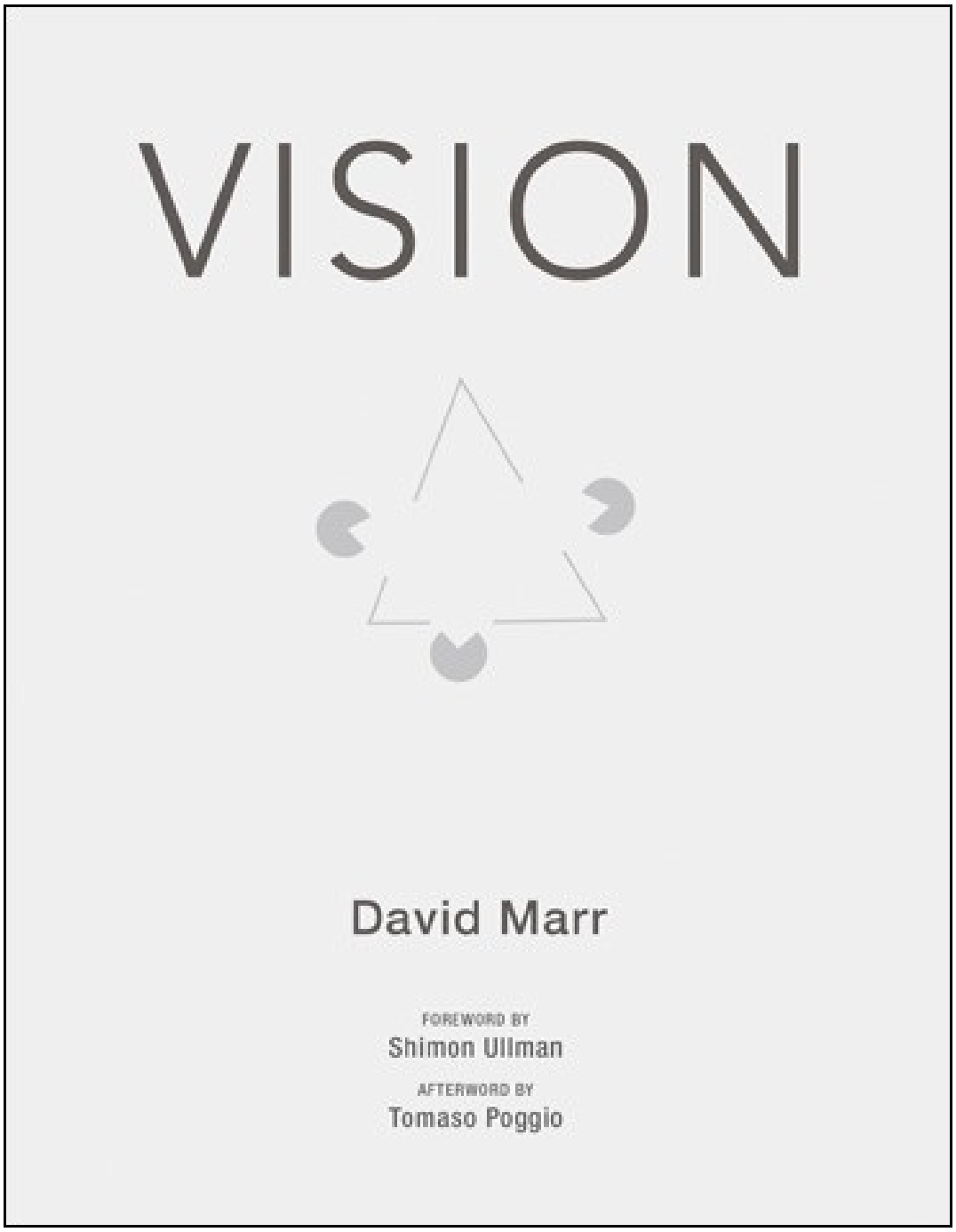
# Cognitive science as complexity science (Favela, 2020) (http://dx.doi.org/10.1002/wcs.1525)




(Favela, 2020) (http://dx.doi.org/10.1002/wcs.1525)

# David Marr (1945-1980)

David Marr

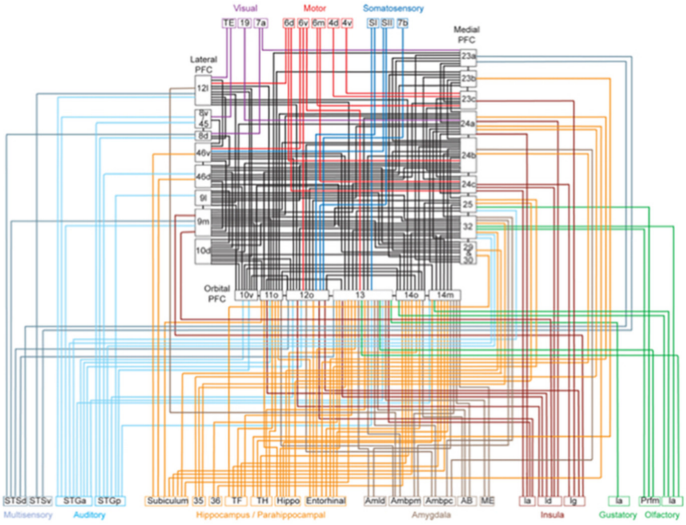



(Marr, 1980) (https://mitpress.mit.edu/books/vision)

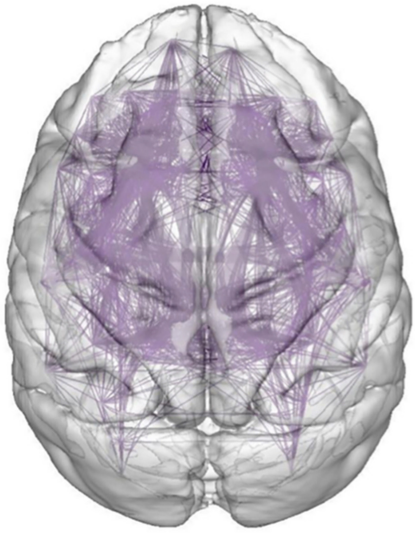
## Marr's Three Levels

Computational Theory

Representation and Algorithm




Hardware Implementation



(Favela, 2020) (http://dx.doi.org/10.1002/wcs.1525)

# Scientific “story-telling” at different levels of analysis

- Temporal
  - Short/medium/long
- Spatial
  - Small/medium/large

# Your turn

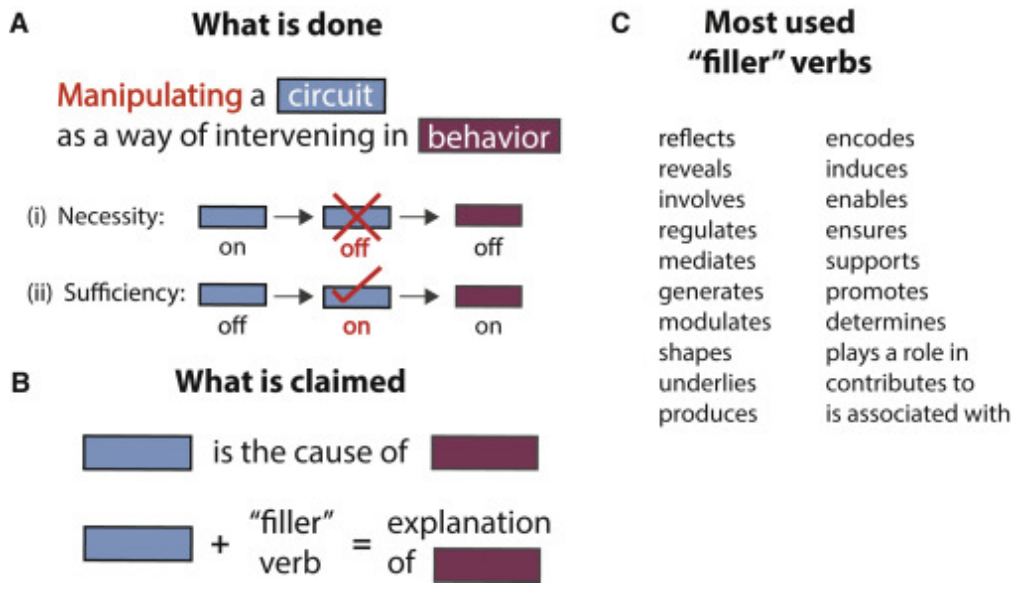
**Does neuroscience need behavior? Does behavioral science need the brain?**

# Discussion of…

Krakauer, J. W., Ghazanfar, A. A., Gomez-Marin, A., MacIver, M. A., & Poeppel, D. (2017). Neuroscience needs behavior: Correcting a reductionist bias. *Neuron*, *93*(3), 480–490. https://dx.doi.org/10.1016/j.neuron.2016.12.041 (https://dx.doi.org/10.1016/j.neuron.2016.12.041).

# Key points

- Questions ‘often tacit…belief in the reductionist program for understanding the link between brain and behavior’
- Behavior -> understanding; neural inverventions -> causality
- Marr’s 3 levels (computation; algorithm; implementation)




(Krakauer, Ghazanfar, Gomez-Marin, MacIver, & Poeppel, 2017) (http://dx.doi.org/10.1016/j.neuron.2016.12.041)

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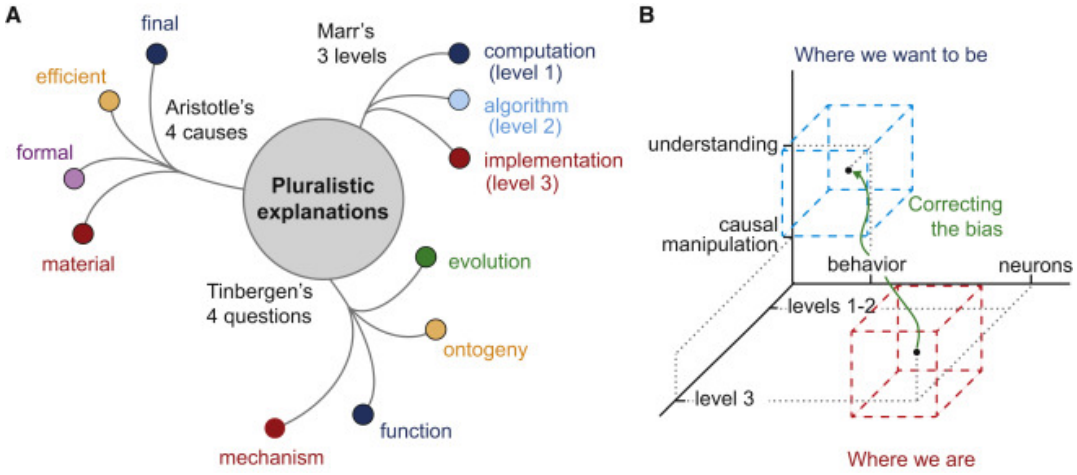


(Krakauer, Ghazanfar, Gomez-Marin, MacIver, & Poeppel, 2017) (http://dx.doi.org/10.1016/j.neuron.2016.12.041)

# Main points

- Levels of analysis
- Neuroscience needs behavior; behavioral science needs neuroscience

# Your turn

### 1. Pick two papers you want to read and (better) understand

- Email me APA formatted citation (with DOIs)
- Indicate three concepts/terms you are especially interested in understanding

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### 2. Choose a behavior or mental state you want to (better) understand

- Take an information processing perspective and briefly sketch out (in no more than a short paragraph) the main inputs, outputs, and computations involved.
- When thinking about *outputs* make sure to distinguish between *behaviors* (e.g., movements, facial expressions, vocalizations) and *physiological states* (e.g., changes in heart rate, hormone concentrations in the blood, etc.)

# References


Favela, L. H. (2020). Cognitive science as complexity science. *Wiley Interdisciplinary Reviews: Cognitive Science*, *11*(4), e1523. https://doi.org/10.1002/wcs.1523 (https://doi.org/10.1002/wcs.1523)

Krakauer, J. W., Ghazanfar, A. A., Gomez-Marin, A., MacIver, M. A., & Poeppel, D. (2017). Neuroscience needs behavior: Correcting a reductionist bias. *Neuron*, *93*(3), 480–490. https://doi.org/10.1016/j.neuron.2016.12.041 (https://doi.org/10.1016/j.neuron.2016.12.041)

Marr, D. (1982). *Vision*. Retrieved from https://mitpress.mit.edu/books/vision (https://mitpress.mit.edu/books/vision)

Sejnowski, T. J., Churchland, P. S., & Movshon, J. A. (2014). Putting big data to good use in neuroscience. *Nat. Neurosci.*, *17*(11), 1440–1441. https://doi.org/10.1038/nn.3839 (https://doi.org/10.1038/nn.3839)