METHODOLOGY BOX

9.1 Parallel distributed processing (PDP) modeling of cognition

PDP Models

How They Work

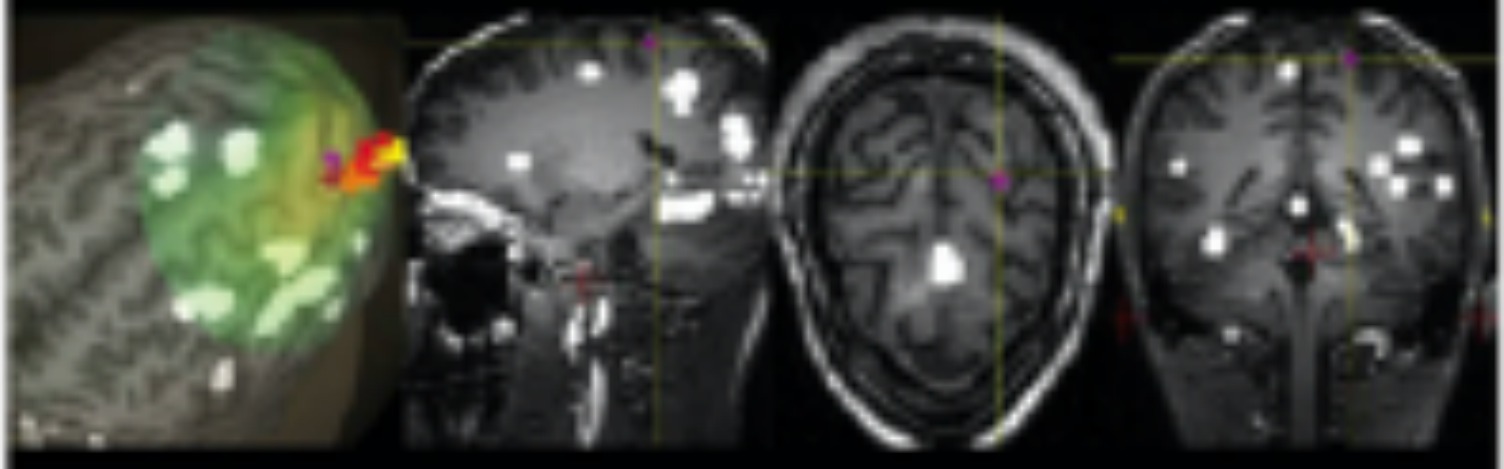
- We talked about two broad classes of models last lecture: **cognitive models** and **structural/ neurological models**

  - Note that what I'm calling a 'neurological' model can be referred to by slightly different terms, e.g neuropsychological model, systems neuroscience model, etc…. don't worry too much about the names but rather focus on how these two broad categories of models differ

- One type of model that (debatably) could be considered intermediate between the two named above is a '**Parallel Distributed Processing**' (**PDP**) model

  - Knowledge is represented in the *distributed pattern of activity* of many **units** (or 'nodes')

  - **Weights** (values between 0 and 1) at each of the many **connections** determine how signals sent from a given unit will either increase or decrease the activity of the next unit when transmitted through that particular connection



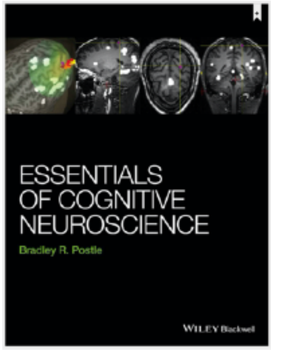
ESSENTIALS OF COGNITIVE NEUROSCIENCE

Bradley R. Postle

WILEY Blackwell

PDP Models

How They Work



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PDP Models

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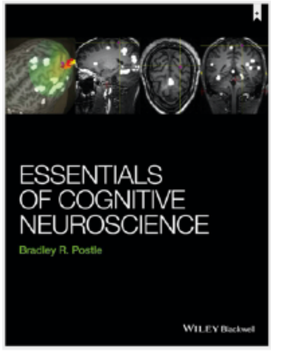

- **PDP models** are conceptual in many ways (like cognitive models), yet the fact that the essential 'pieces' look/work a whole lot like how we understand neurons look/work (i.e. communicate) means it has a biologically plausible form that we could consider a sort of '**neural network**' (hence the role/application in **artificial intelligence**!)
  - This is similar to how repeated firing of connected neurons can strengthen those connections (**Long-Term Potentiation, LTP**: '*Neurons that fire together wire together*': Donald Hebb)
  - Can also relate **Long-Term Depression (LTD)** to these models, in which repeated firing can also (depending on how everything is connected) selectively weaken connections
- This interplay between strengthening/weakening certain connections to 'fine-tune' operation of the system to accomplish some goal can be compared to what happens when neural networks 'learn' to do things (usually through trial/error) by modifying connection weights