Week 6 – First-level fMRI data analysis

L06-02. BOLD and Canonical HRF

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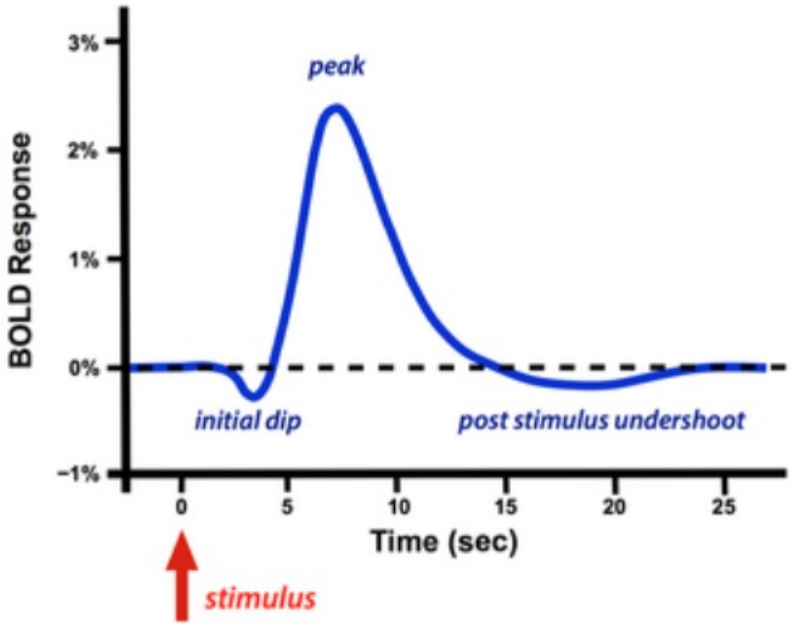
- Before HRF, what is BOLD?
  - The most common approach towards fMRI uses the BOLD contrast .
  - **BOLD** = Blood Oxygenation Level Dependent
  - It measures the ratio of oxygenated to deoxygenated hemoglobin in the blood.
  - **Hemoglobin** exists in two different states each with different magnetic properties producing different local magnetic fields
    - **Oxy**hemoglobin is diamagnetic
    - **Deoxy**hemoglobin is paramagnetic
  - It doesn't measure neuronal activity directly, instead it measures the metabolic demands (oxygen consumption) of active neurons.

Slide credit: Coursera - Principles of fMRI (part1)

❖ What is Hemodynamic Response Function (HRF)?

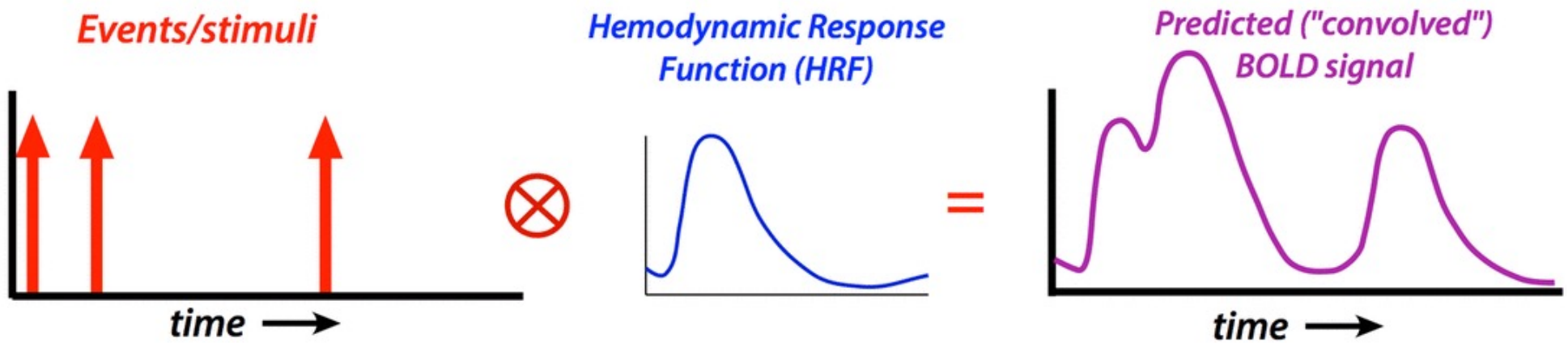
- Dynamic BOLD response is characterized by HRF; the regional BOLD response generated from a brief peripheral stimulus is know as the HRF.
- The HRF typically demonstrates:
  1. a small initial dip: initial increases in deoxyhemoglobin can lead to a decrease in BOLD signal
  2. a tall peak: an over-compensation in blood flow dilutes the concentration of deoxyhemoglobin and tips the balance toward oxyhemoglobin, which leads to a peak in BOLD signal about 4-6 seconds following activation
  3. a variable post-stimulus undershoot: due to a combination of reduced blood flow and increased blood volume



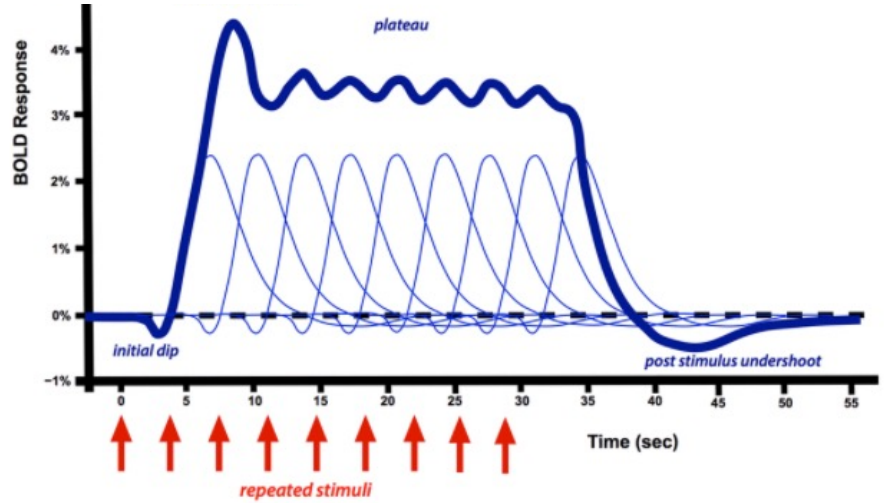
BOLD Hemodynamic Response Function (HRF) following a single brief stimulus

http://mriquestions.com/does-boldbrain-activity.html

❖ What is Hemodynamic Response Function (HRF)?



- A regressor is created by convolving the HRF with the experimental design.
- If multiple repeated stimuli are added together, the dominant peak becomes a broad plateau, not dropping off until the stimulation ends.



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Cocoan 101

https://cocoanlab.github.io