A widespread task-related hemodynamic response in human V1 is modulated by task difficulty

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### Aim
- Are task-related hemodynamic responses modulated by task difficulty and reward?
- Are they linked to arousal?

### Background

Task-related hemodynamic responses:
- Endogenous responses in the absence of a visual stimulus at the earliest stages of visual cortical processing.
- Spatially global and entrained to task timing.

### Task Difficulty

#### fMRI responses in ipsilateral V1:

![Graph showing fMRI responses for Easy and Hard conditions](image)

#### Pupil responses:

![Graph showing pupil area responses for Easy and Hard conditions](image)

### Reward

#### fMRI responses in ipsilateral V1:

![Graph showing fMRI responses for Low Reward and High Reward conditions](image)

#### Pupil responses:

![Graph showing pupil area responses for Low Reward and High Reward conditions](image)

### Conclusions
- Task-related responses entrained to task timing.
- Pupil dilation also modulated by difficulty, reward, and correct/incorrect feedback.
- Task-related responses reflect arousal.

### Experimental Protocol

- **Easy** or **Low Reward**
  - ~90% correct
  - Stakes: $0.25

- **Hard** or **High Reward**
  - ~70% correct
  - Stakes: $1.10

- Orientation discrimination task; tone feedback.
- Separate runs (of 15 trials) for four conditions (easy vs. hard, low reward vs. high reward).

### V1, Ipsilateral hemisphere: widespread hemodynamic activity unrelated to visual stimulus or spatial attention

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