

NEURAL COMPUTATION

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REVIEW

- * Deductive experiments
 - * “Face area” localization

LIMITS OF DEDUCTION

- * Each experiment is designed to a small number of hypotheses
- * What if truth doesn't clean map onto these hypotheses?
- * What if the result doesn't generalize?

INDUCTIVE APPROACH

- * **Measure** brain responses to a wide variety of stimuli
- * **Build** model to predict responses based on stimuli
- * **Test** whether model generalizes to different stimuli
- * **Use** model to answer questions about brain

NATURAL STIMULI

THIS:

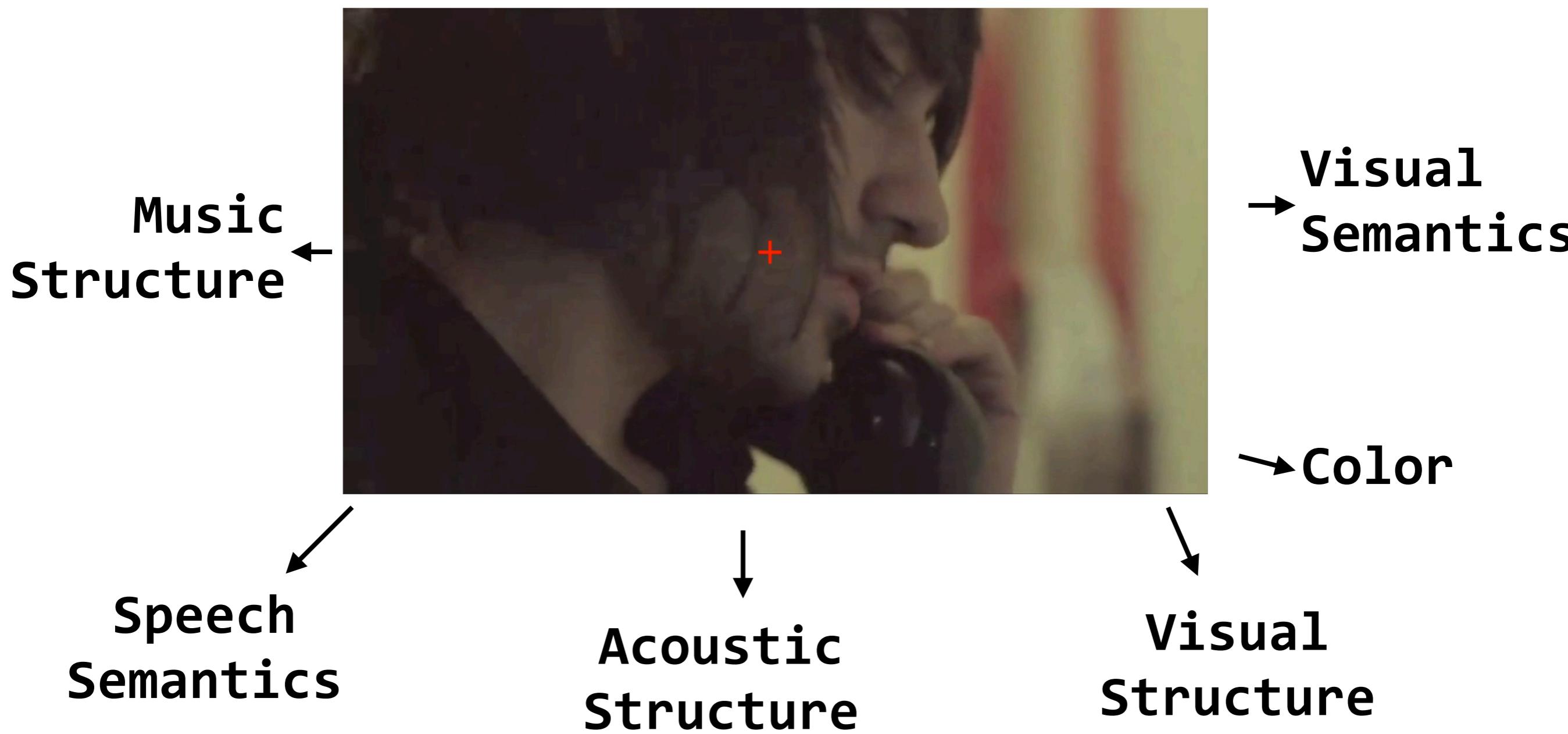


NOT THIS:

chairs



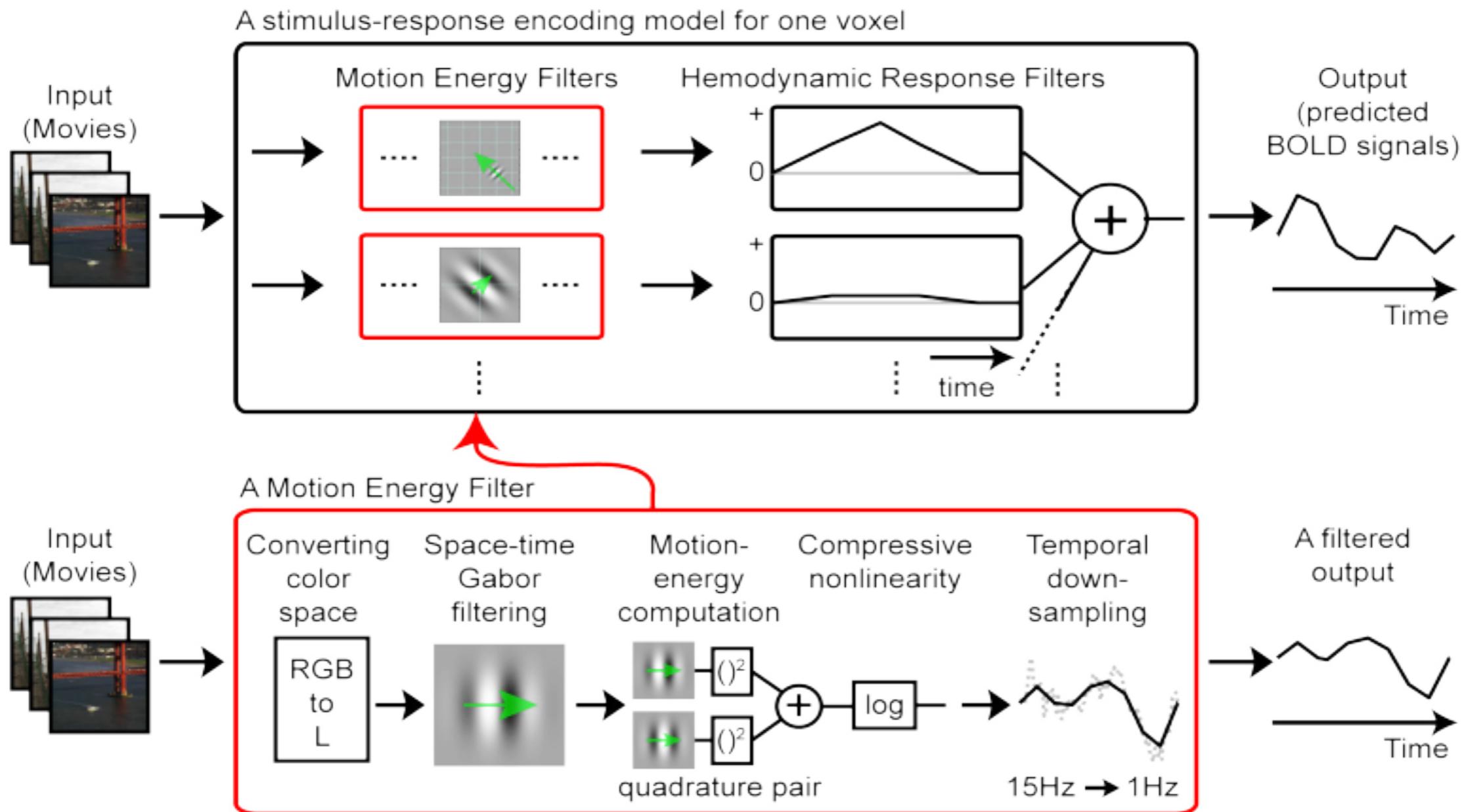
NATURAL STIMULI ANSWER MANY QUESTIONS



EXAMPLE: VIDEOS



EXAMPLE: VIDEOS



EXAMPLE: VIDEOS

Image

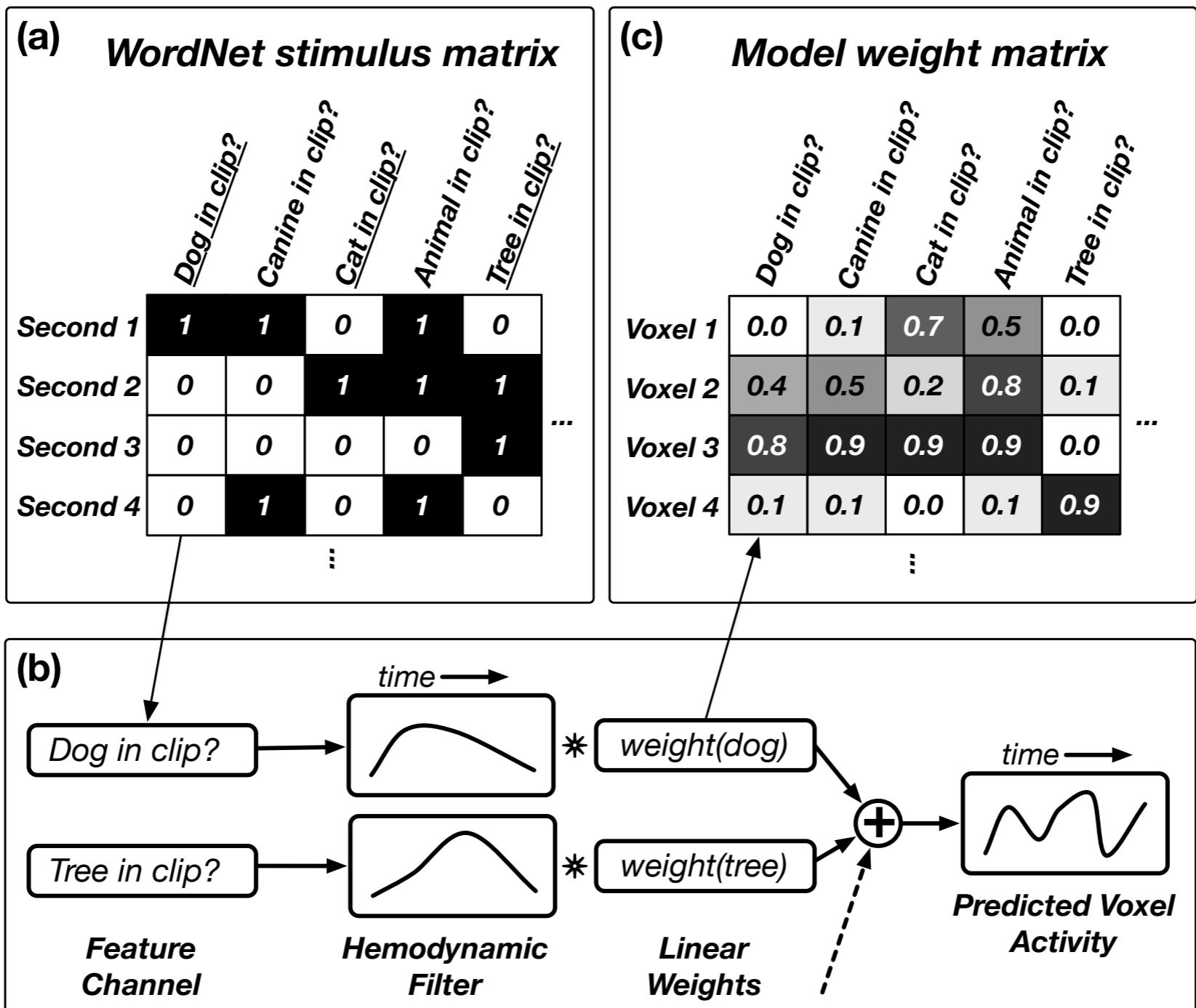


Presented movie

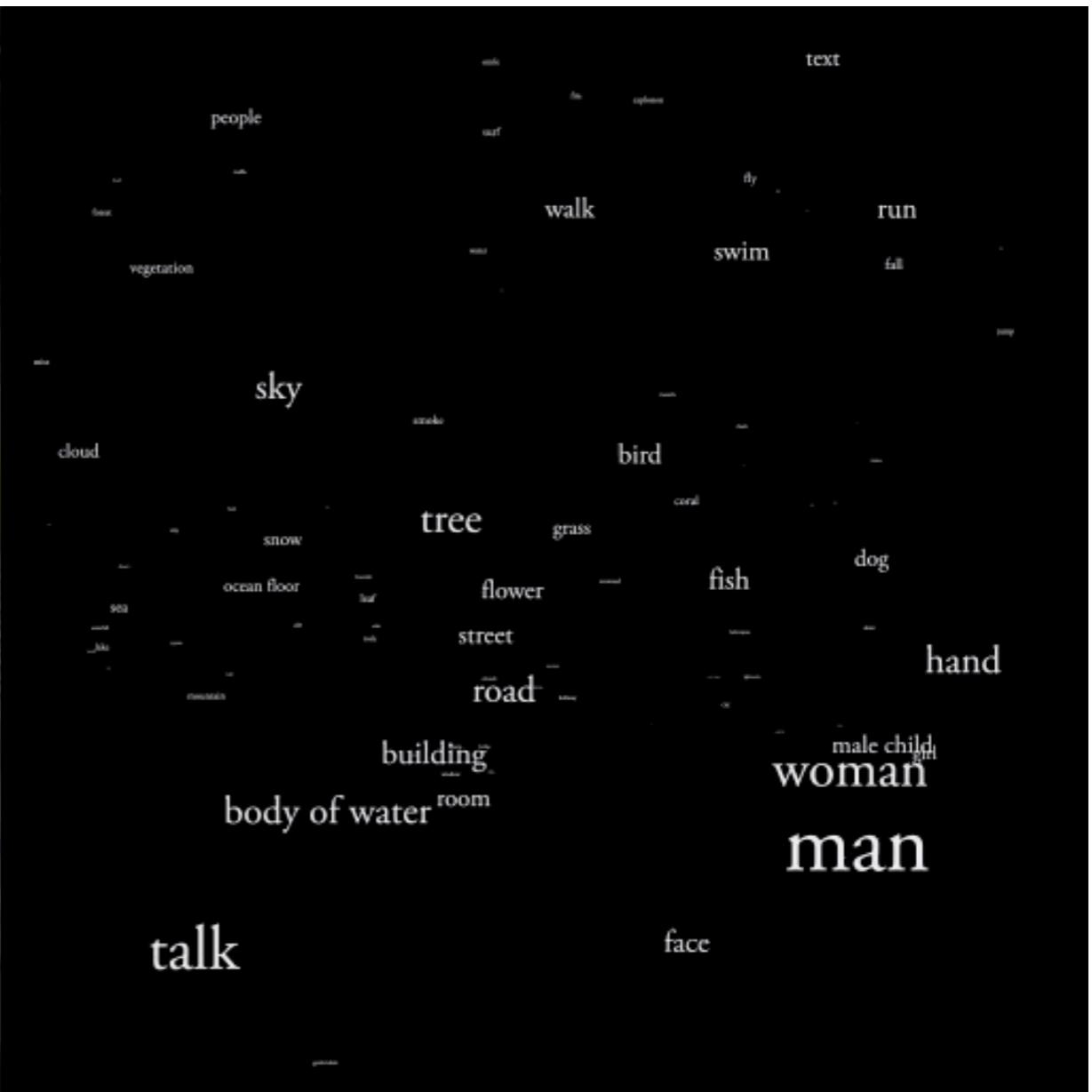
Decoded movie



EXAMPLE: VIDEOS 2



EXAMPLE: VIDEOS 2



NATURAL STIMULI: WHY NOT?

- variables of interest are *confounded* with other variables!
- variables of interest are *correlated* with each other!

CONFOUNDS?

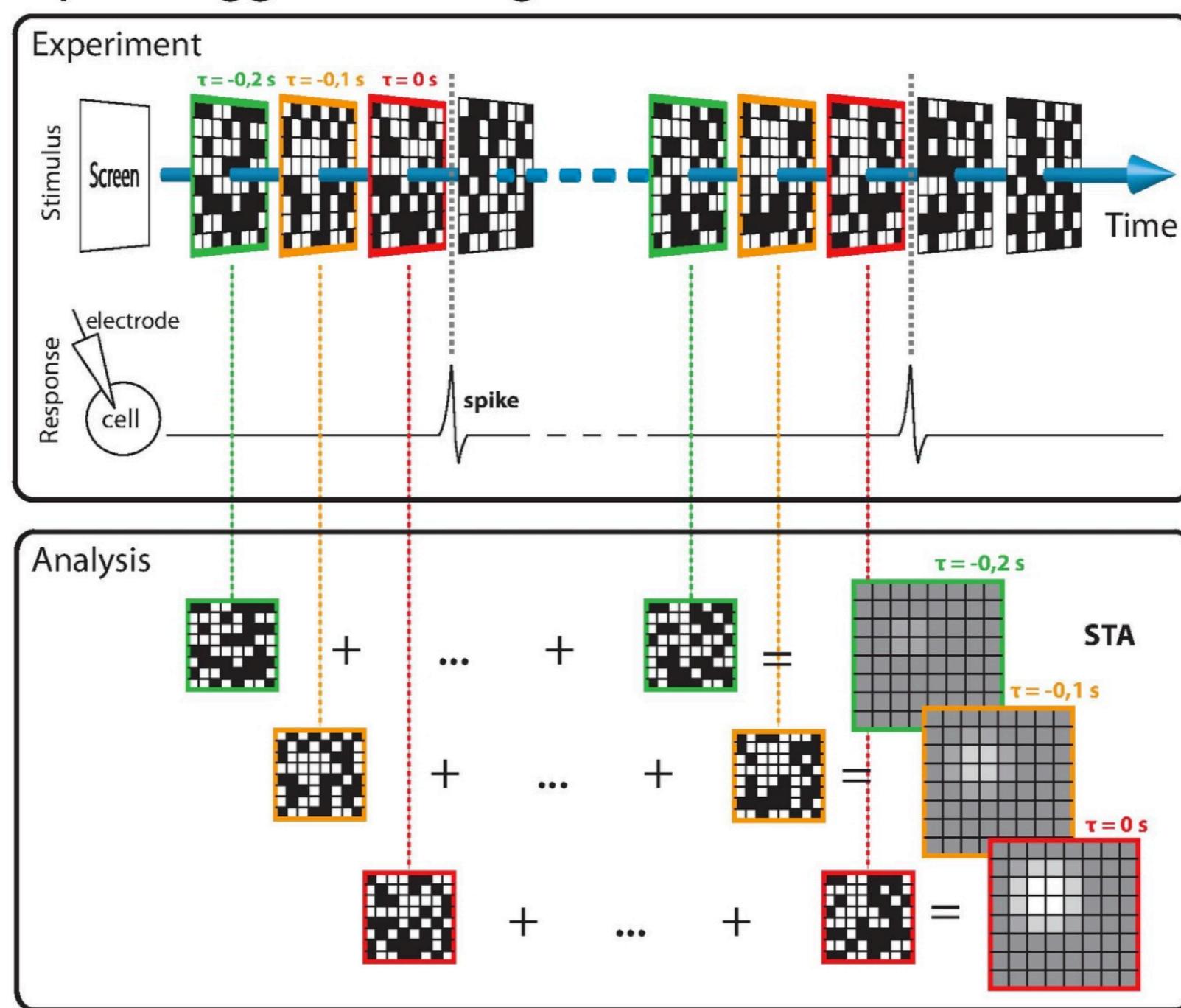
- *Traditional, controlled experiment:*
 - Confounds are baked into design
 - Confounds can be perfectly correlated with design
- *Natural stimuli:*
 - Confounds are just *other variables*
 - If confounds are perfectly correlated in natural stimuli...

SPIKE-TRIGGERED AVERAGE

- * Suppose we are doing an experiment where we record from one neuron in primary visual cortex (V1) while we show images
- * How do we characterize the **receptive field** of this neuron?

SPIKE-TRIGGERED AVERAGE

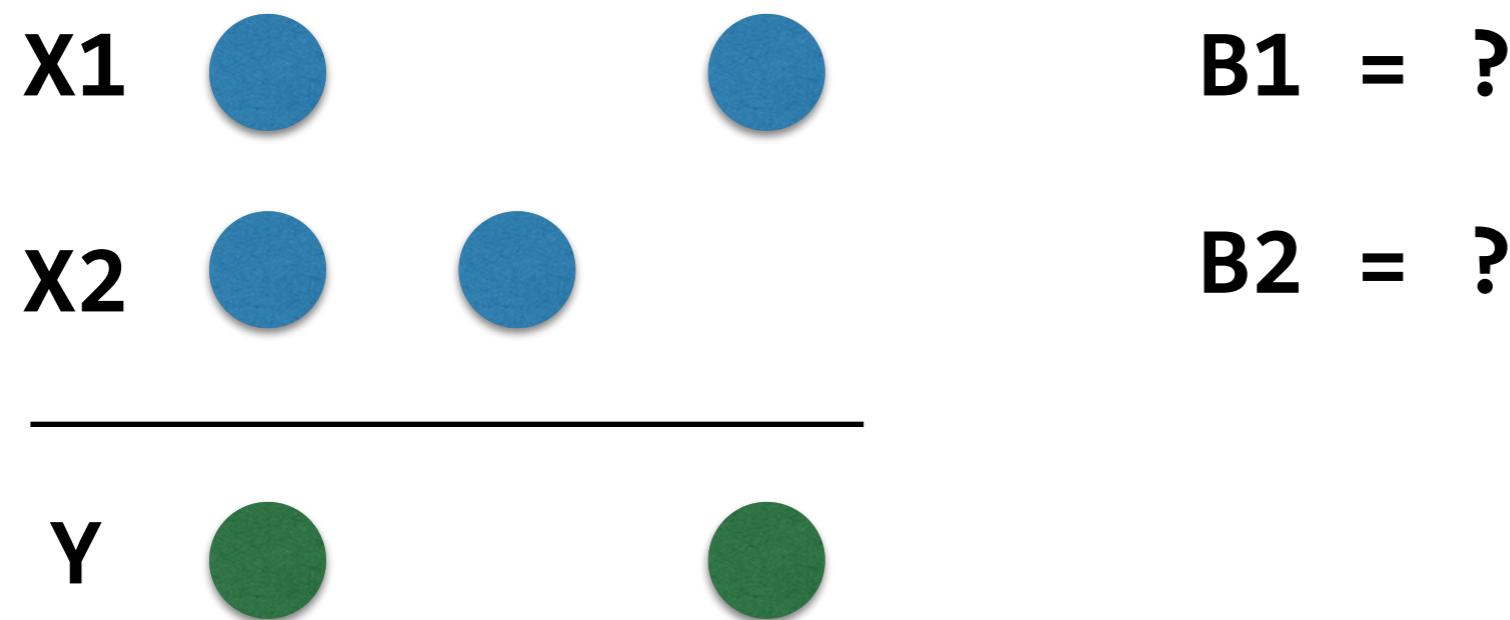
Spike-triggered average (STA)



SPIKE-TRIGGERED AVERAGE

- * What can go **wrong** with the spike-triggered average (STA)?
- * Correctly using STA puts a strong requirement on our **experimental design**. What is it?

SIMPLE EXAMPLE



RECAP

- * Deductive, hypothesis-driven experiments are good at answering a few questions
- * Inductive, data-driven experiments are okay at answering many questions

NEXT TIME

- * System identification!