

Neural Data Analysis

URP 2024, CiCi Zheng, 07/10/24

Agenda Today

Part 1:

- Explore multivariate data in neural behavioral experiments

Part 2:

- Introduce classical models for neural encoding

Some common problems in neuroscience



Stimulus, **x**

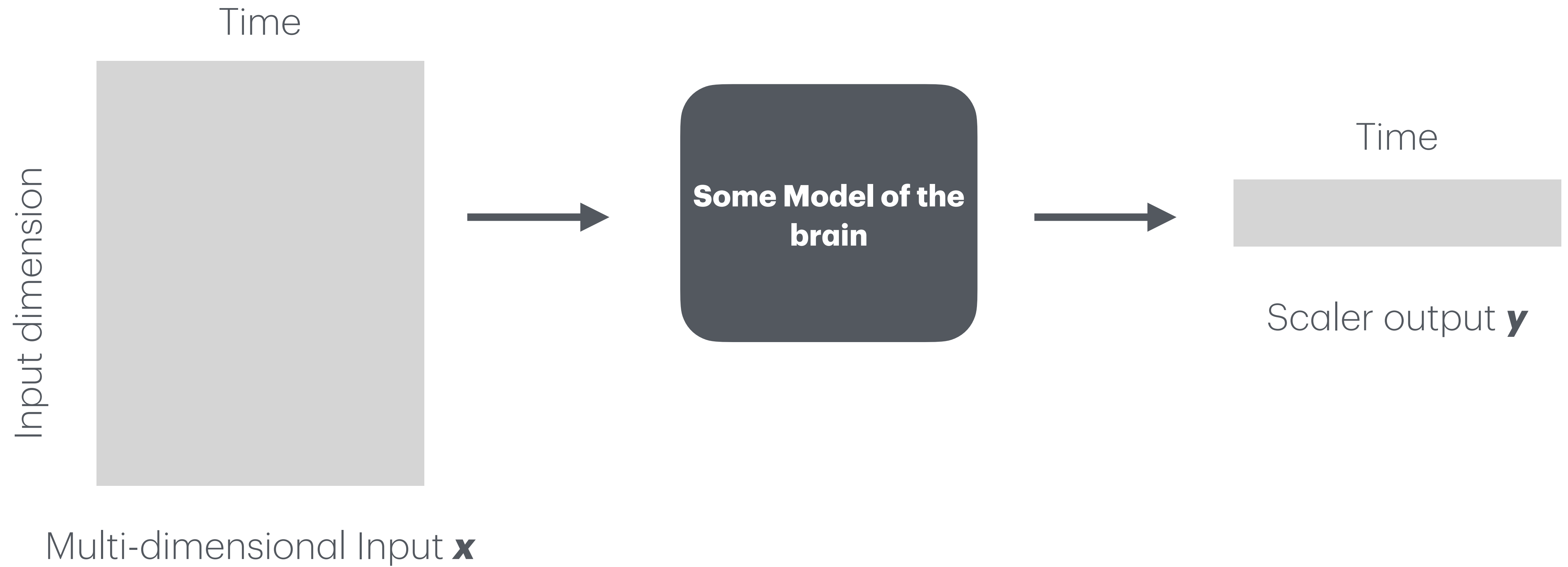


Neural response, **y**

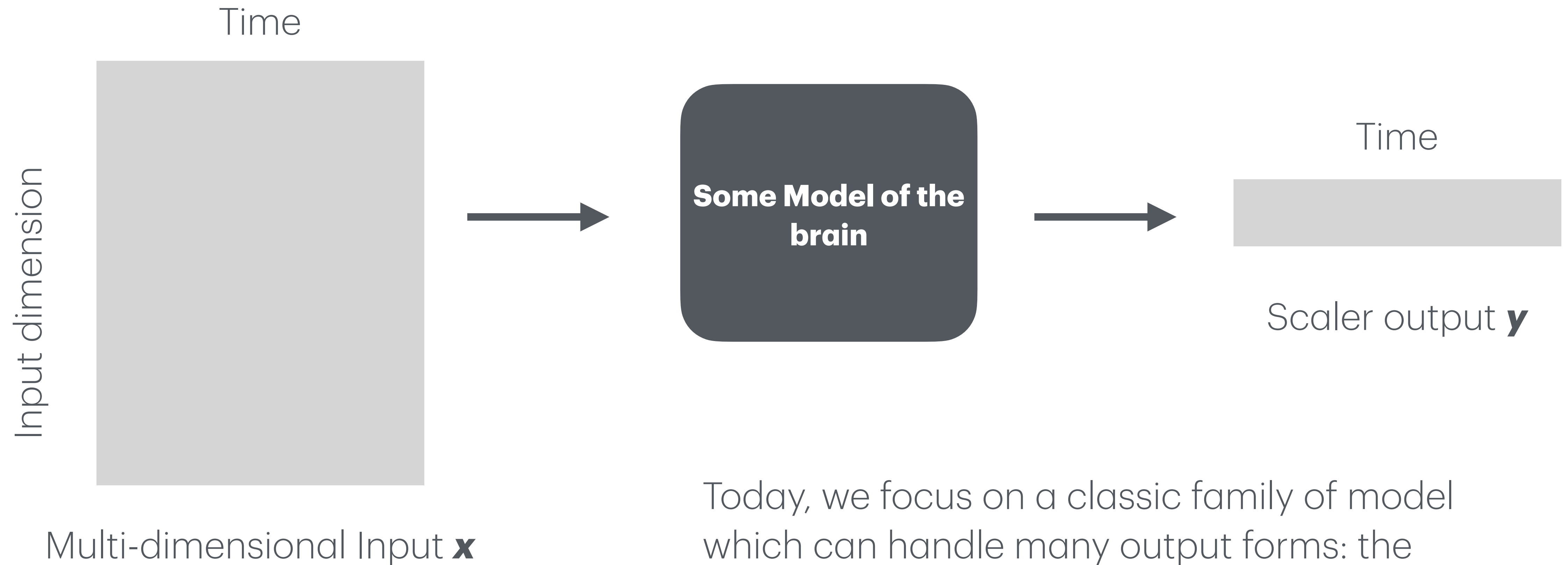
Depending on the brain region and the input:

- "A horse!"
- "Position and speed"
- "Place the bet!"
-

A common formulation



A common formulation

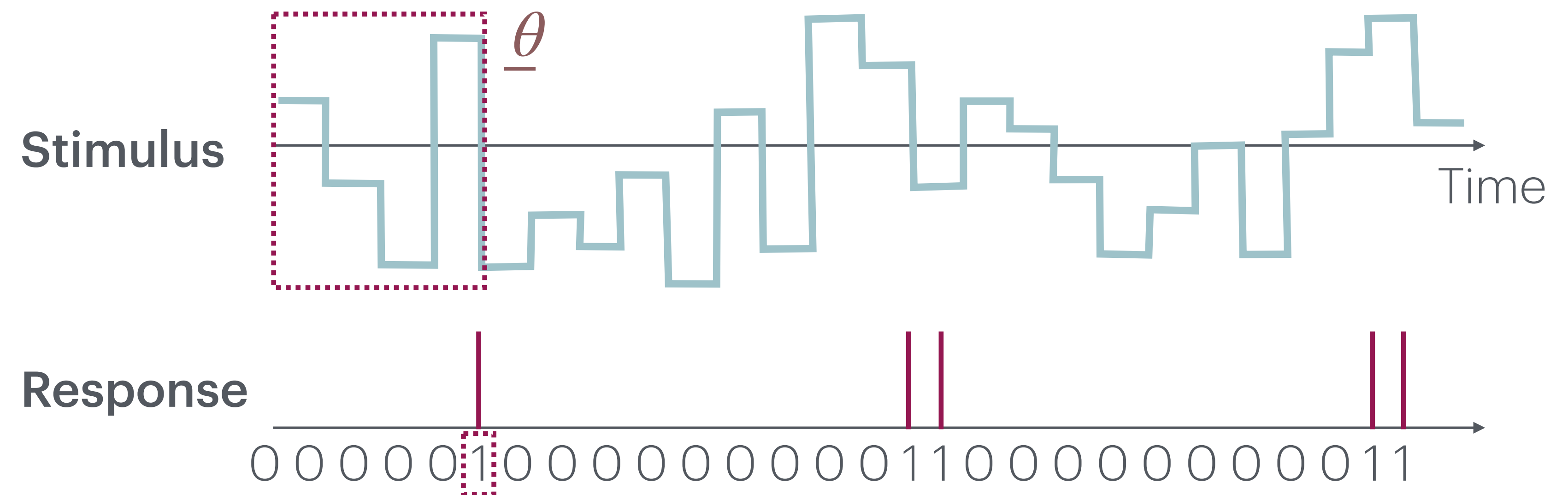
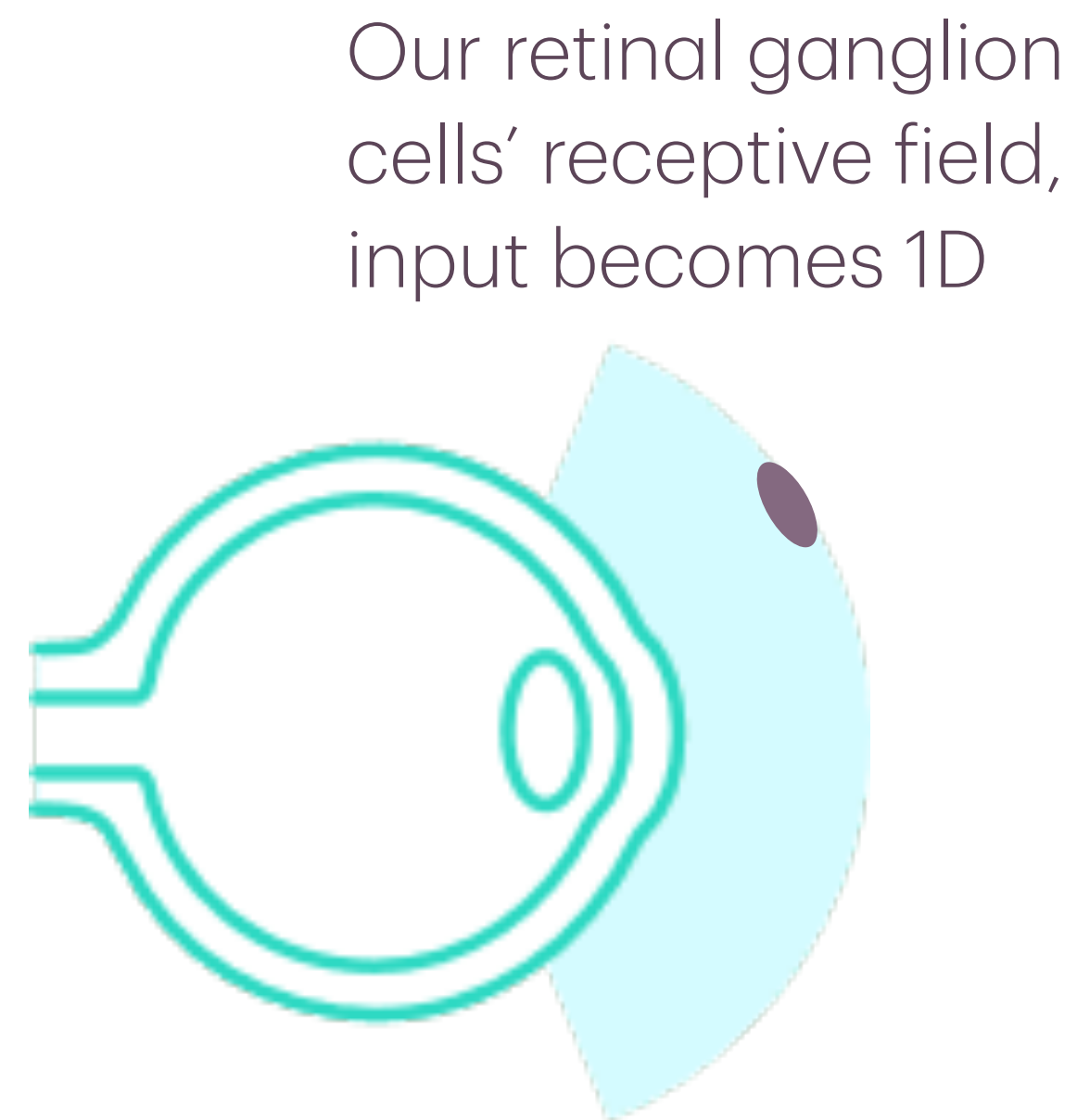


Today, we focus on a classic family of model which can handle many output forms: the **generalized linear models** (GLMs)

An example research question:

“How temporally precise is our early visual system at tracking/encoding the luminous signals?”

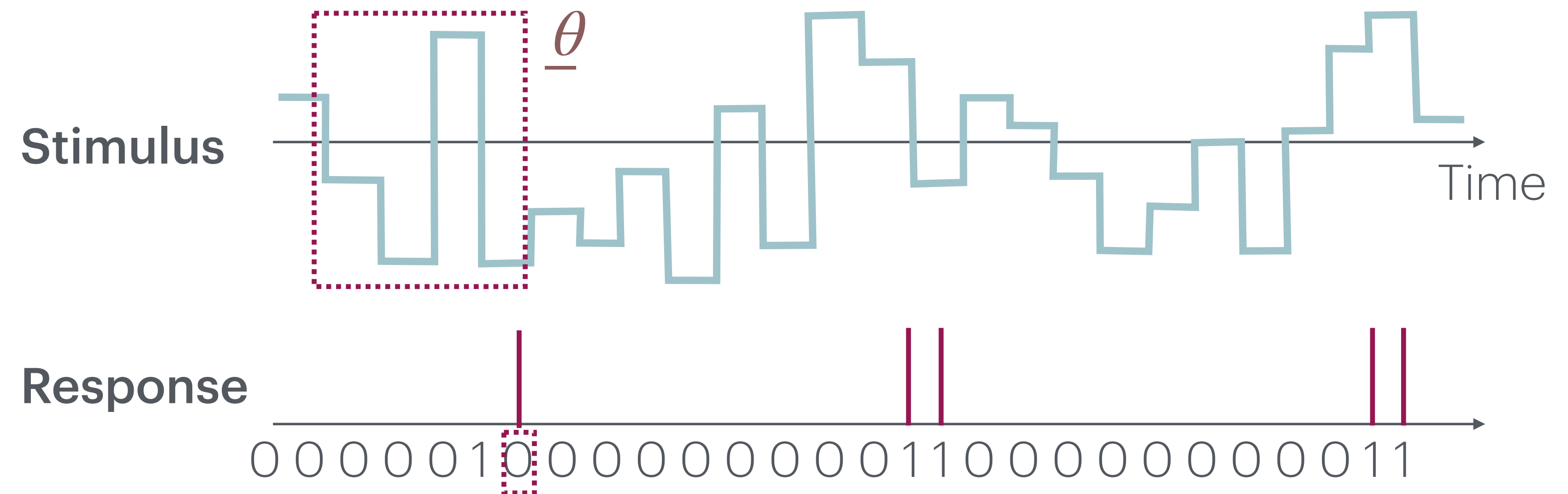
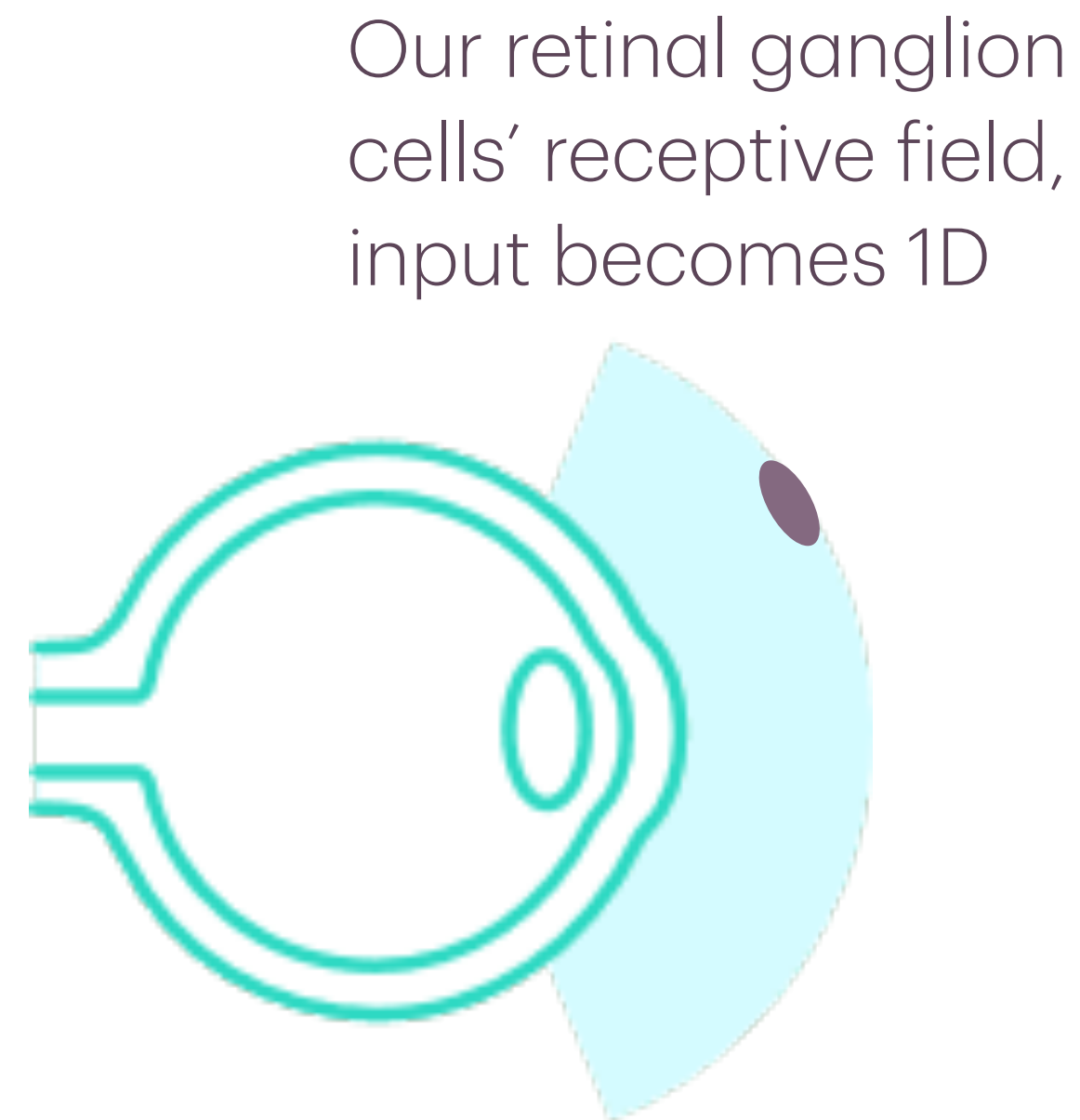
- Let's discretize time for simplicity:



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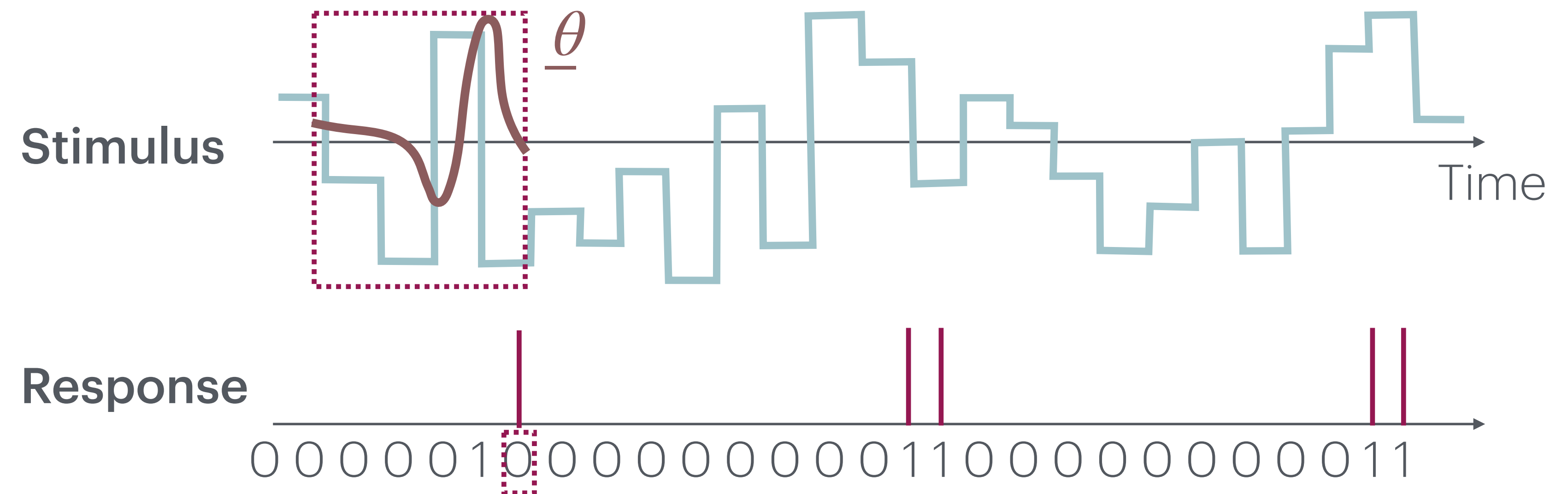
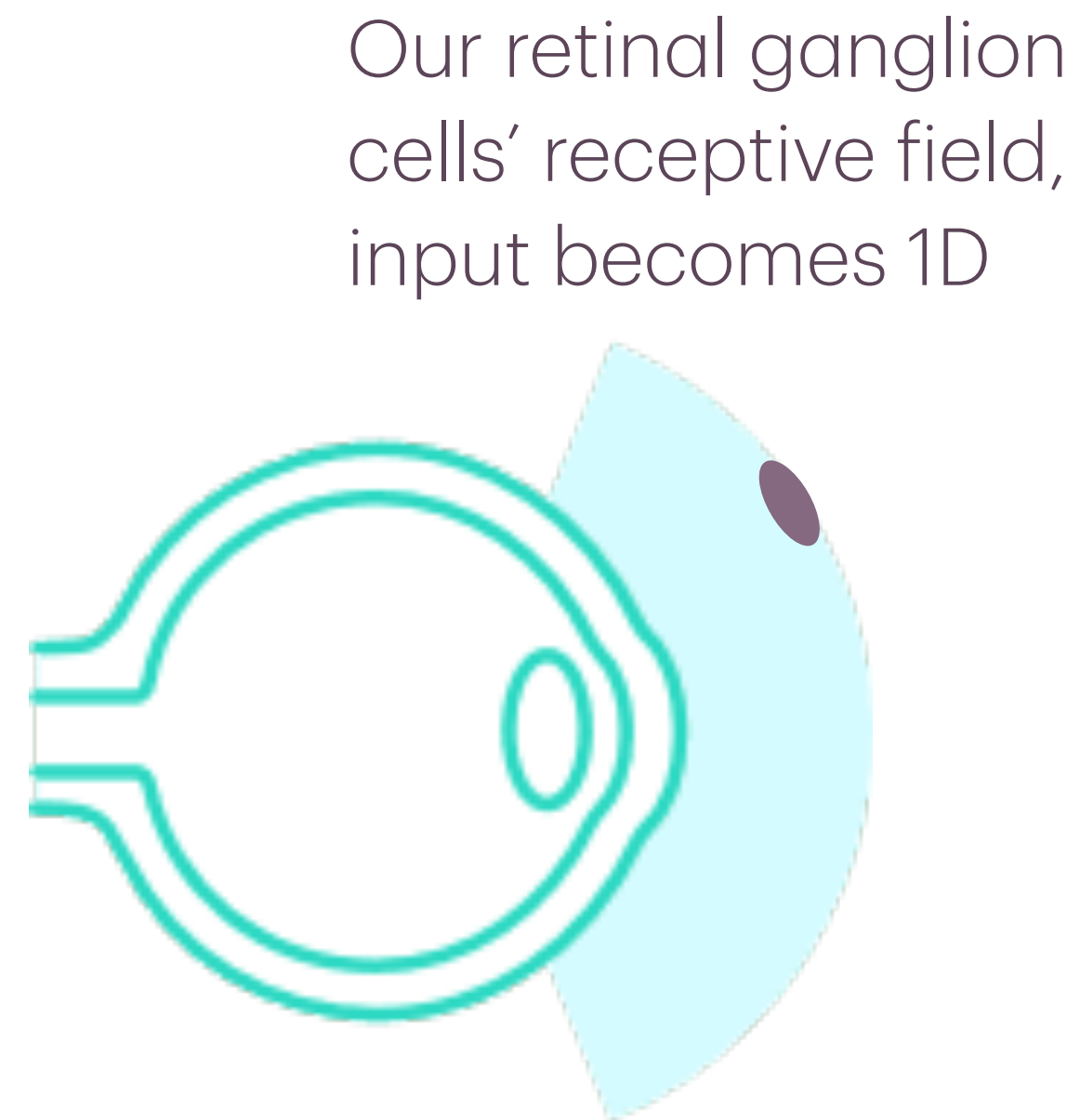
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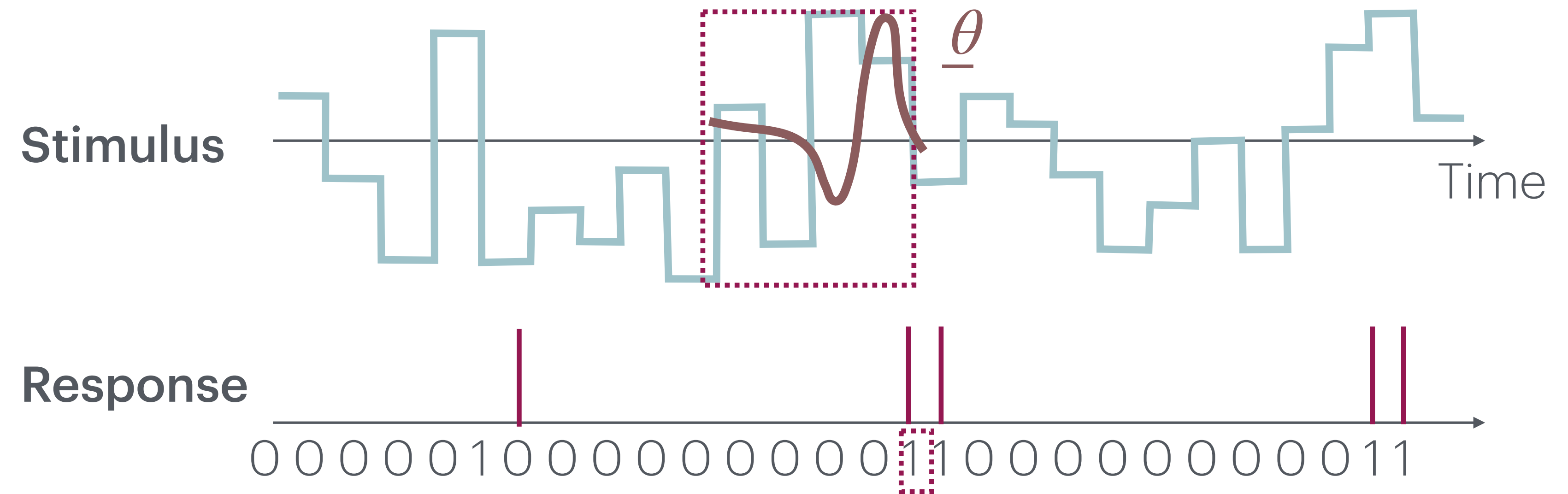
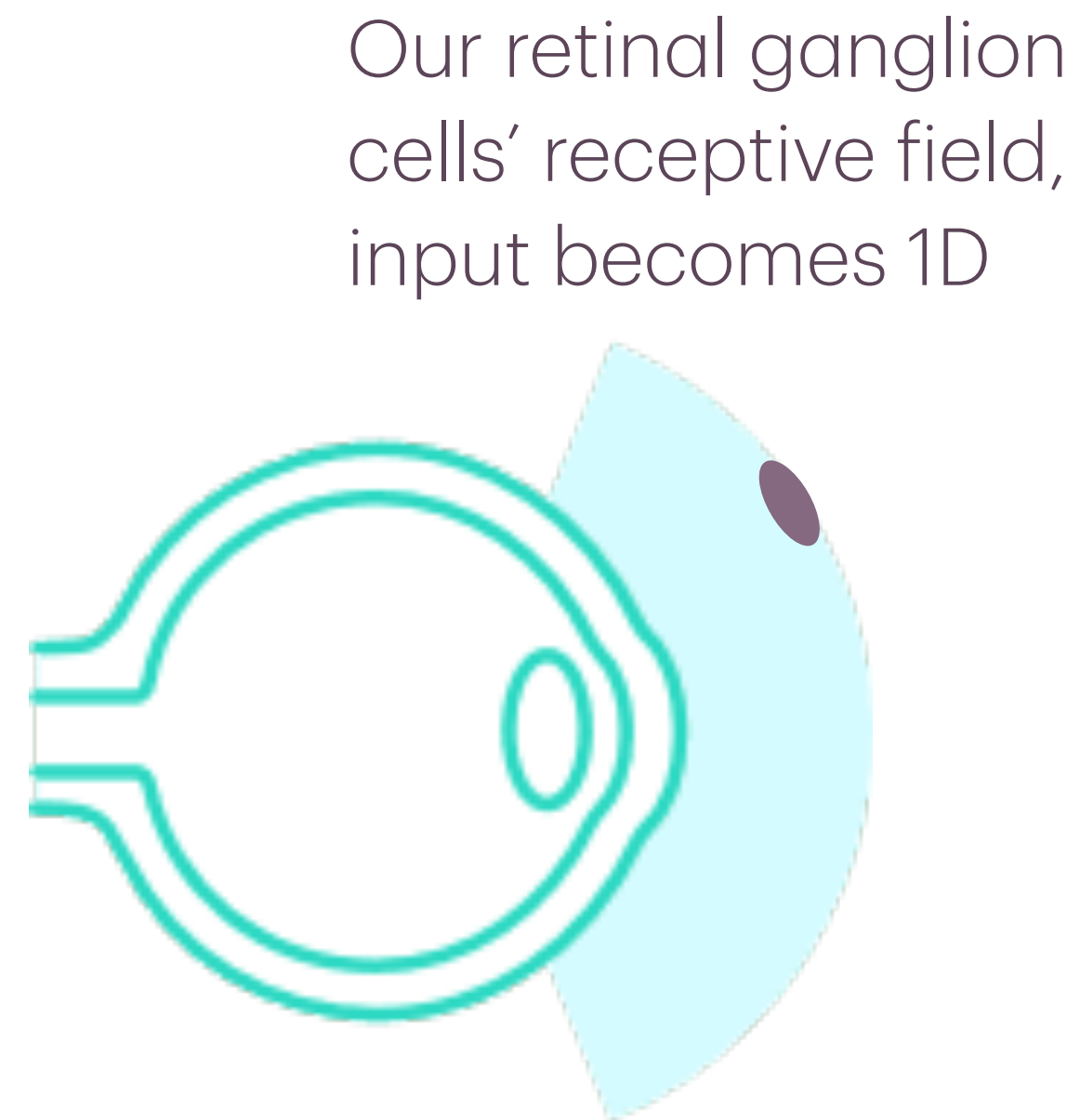


$$y = f\left(\sum_i \theta_i x_i\right)$$

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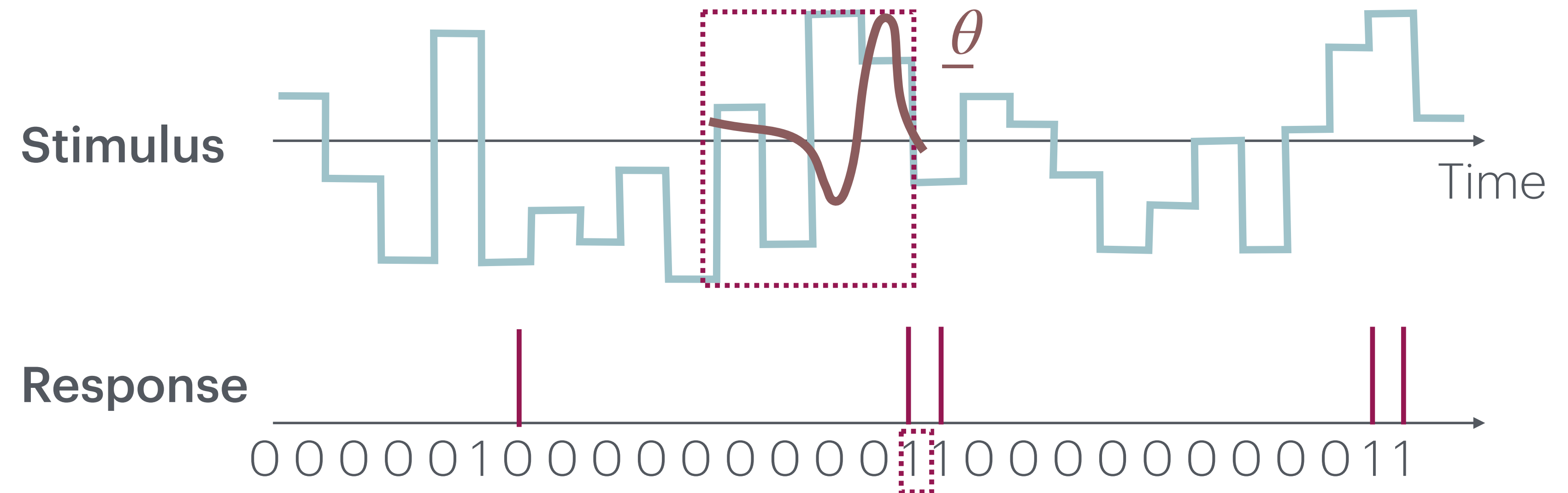
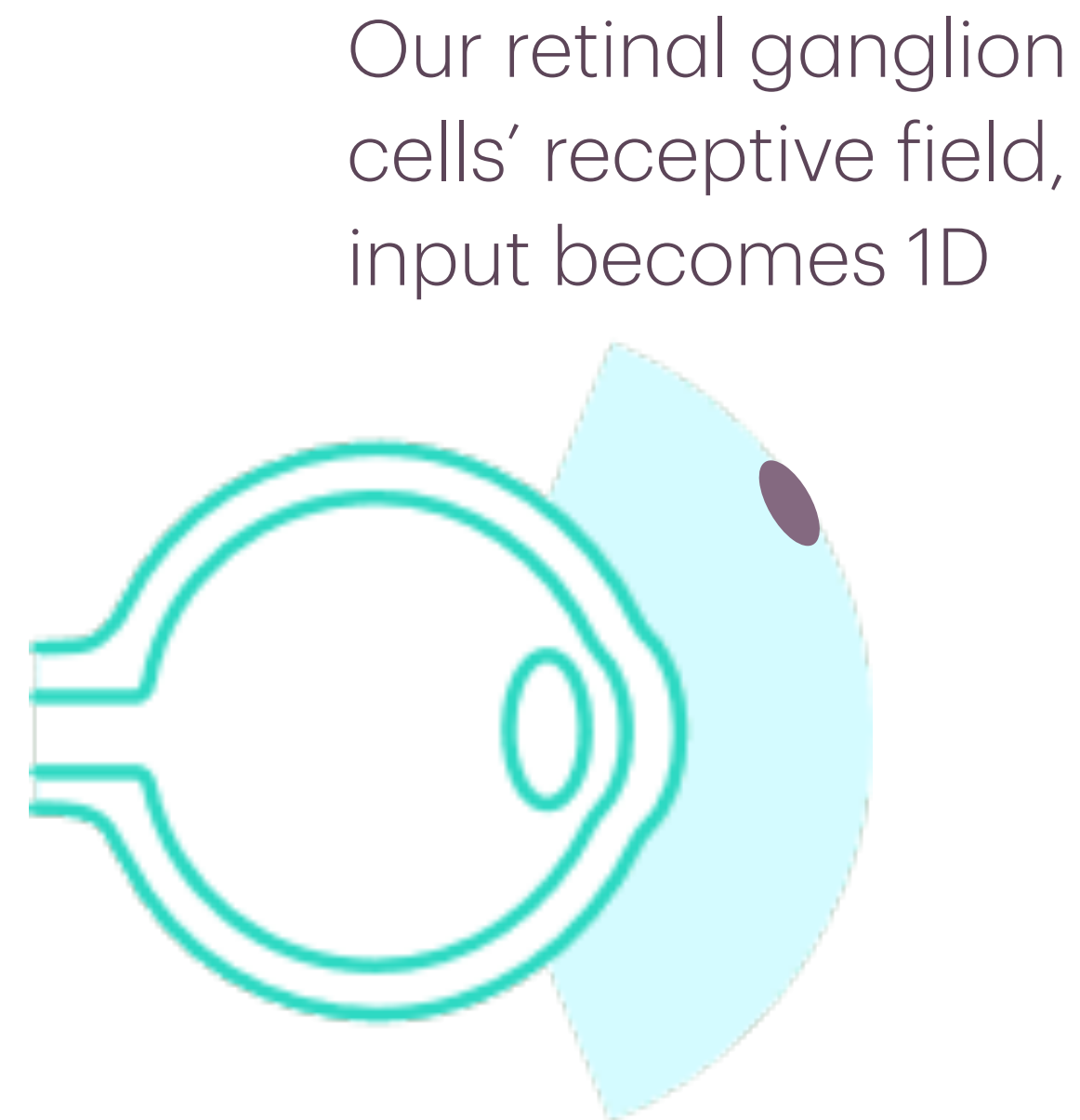


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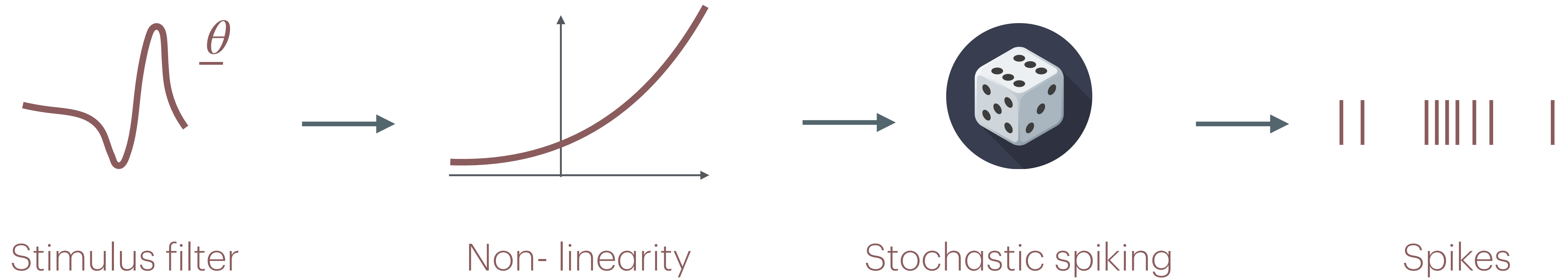
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A slightly more sophisticated model would take into the account of output being 1) discrete; 2) non negative — the Poisson GLM model

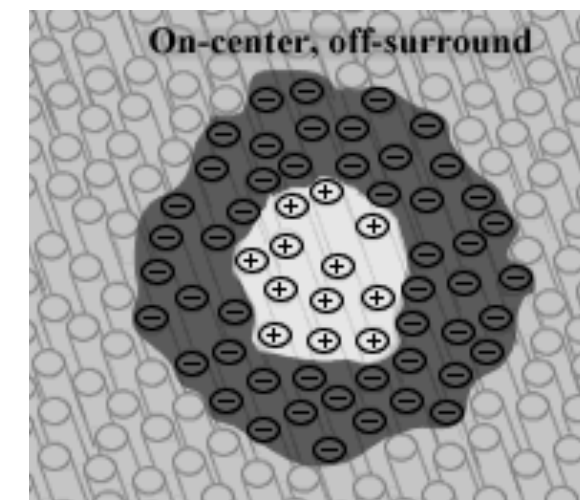
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Poisson GLM

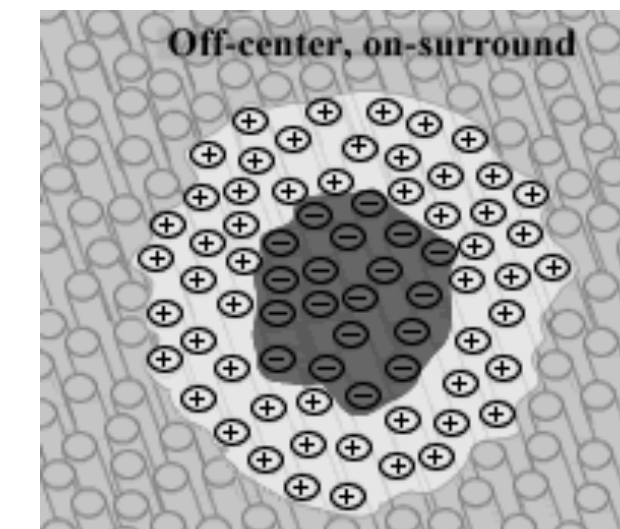


Let's look at some real neural data!

(Uzzell & Chichilnisky, 2004)

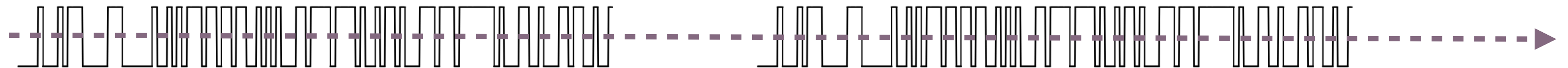


ON



OFF

Stimuli



Response

