ADAPTIVE FILTER MODEL OF THE CEREBELLUM WITH MULTIPLE MODELS (for sound source localisation)

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Cerebellum

Densely populated part of the hindbrain of vertebrates

Highly regular structure

Appears to take part in a wide range of functions
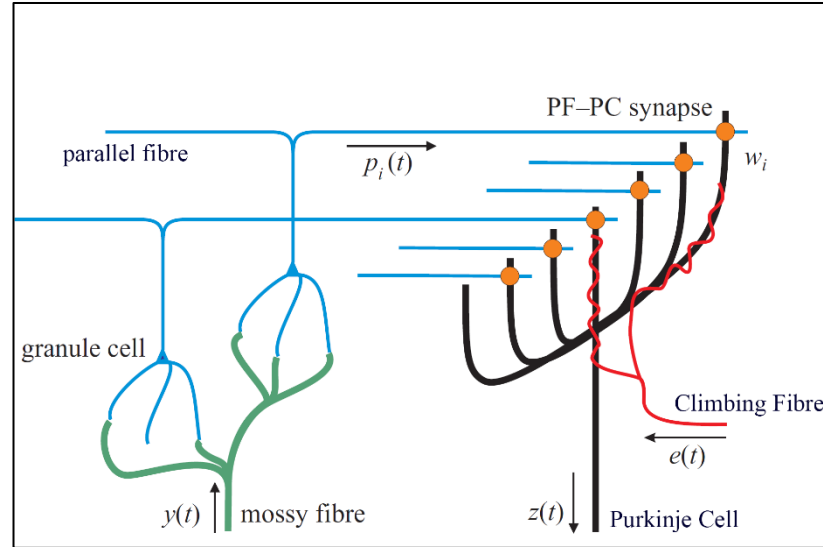
Determined by connectivity

e.g. fine-tuning of motor control; providing a subconscious sense of agency and self

Adaptive filter model of the cerebellum

Analysis-synthesis

Mossy fibres-
sensory input
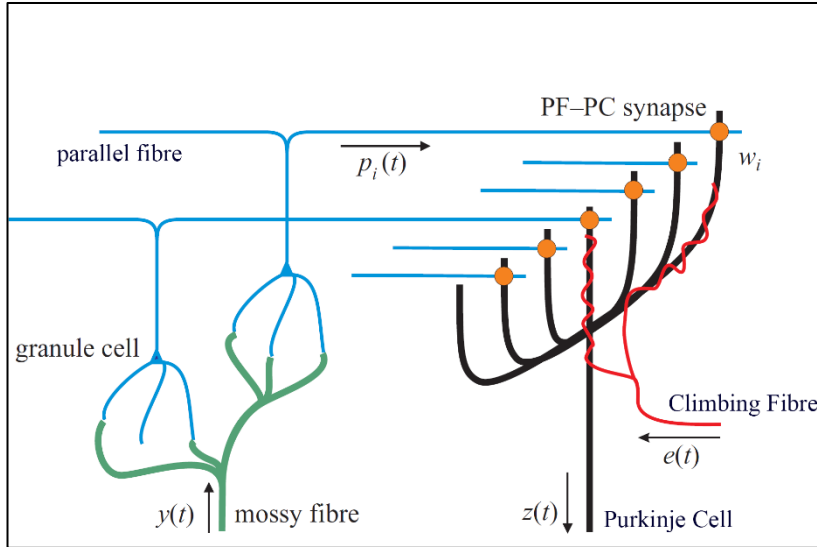
Analysed into
many parallel
fibres

Dean P, Porrill J. Evaluating the adaptive-filter model of the cerebellum. The Journal of physiology. 2011;589(14):3459-70.

Adaptive filter model of the cerebellum
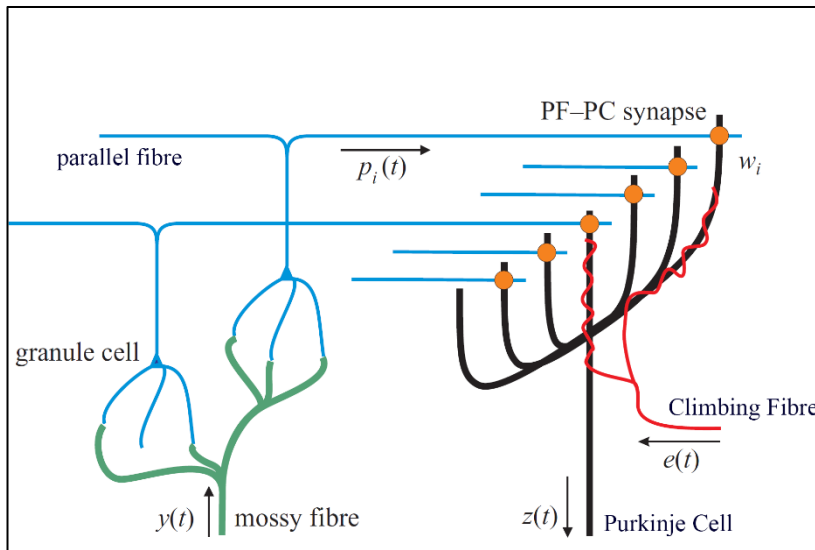
Analysis-synthesis

Synthesised at PF-PC synapses

Dean P, Porrill J. Evaluating the adaptive-filter model of the cerebellum. The Journal of physiology. 2011;589(14):3459-70.

Adaptive filter model of the cerebellum

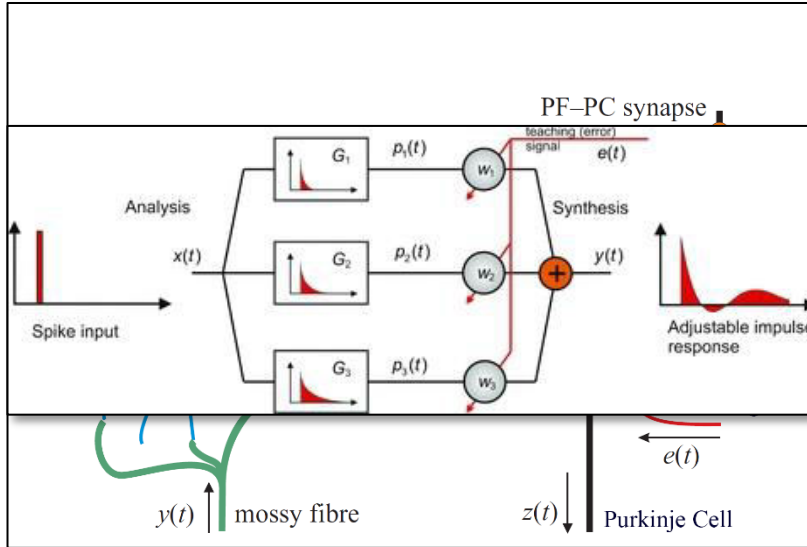Climbing fibres update PF-PC synapses

$$\Delta w_i = -\beta e p_i$$

Dean P, Porrill J. Evaluating the adaptive-filter model of the cerebellum. The Journal of physiology. 2011;589(14):3459-70.

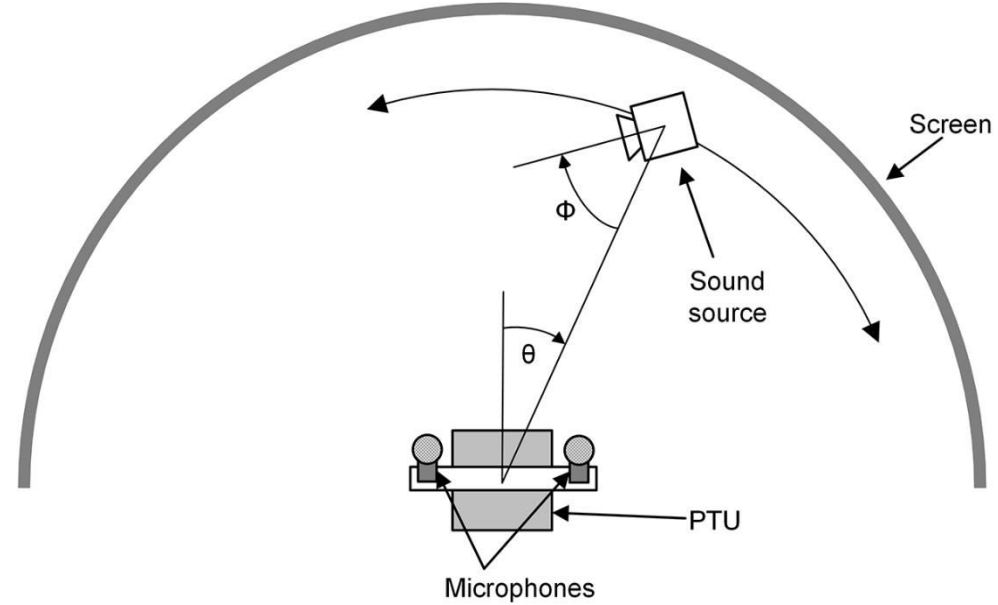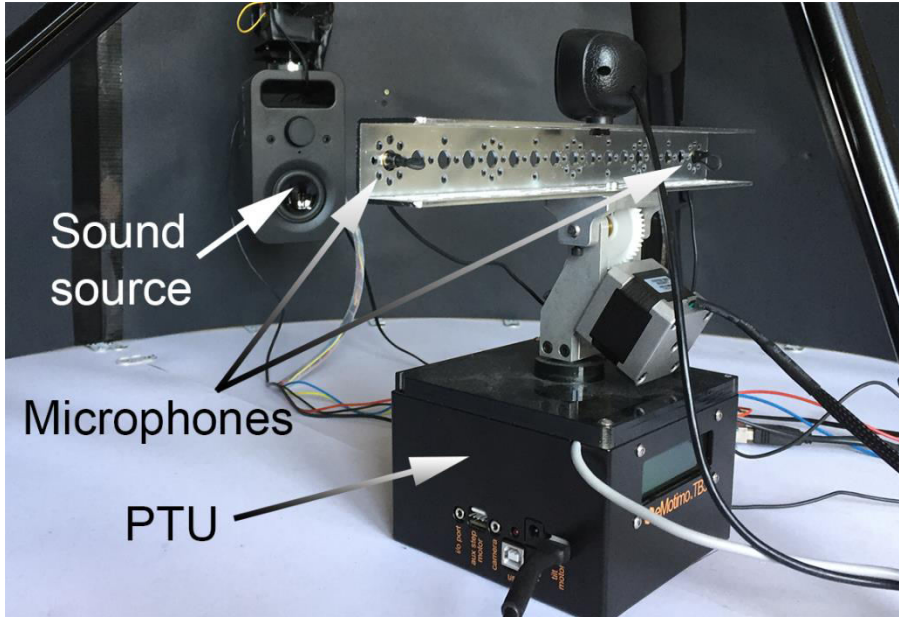# Adaptive filter model of the cerebellum

Basis filters

Rich analysis of inputs

E.g. progressive delays convey historical behaviour-predictive

Dean P, Porrill J. Evaluating the adaptive-filter model of the cerebellum. The Journal of physiology. 2011;589(14):3459-70.

Sound source localisation (SSL)

The problem(s)

SSL estimate error introduced by environmental acoustics, in non-systematic way

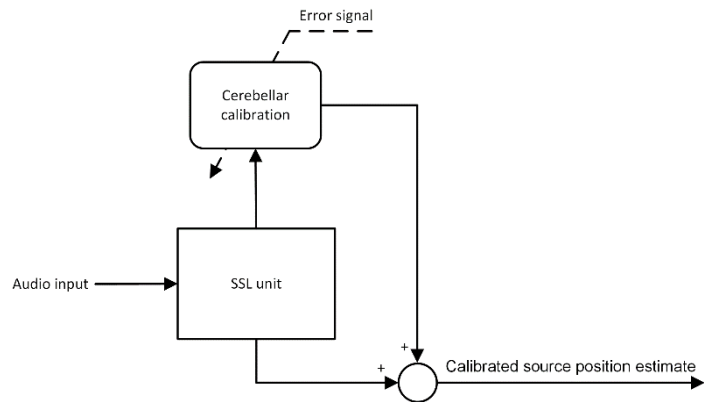(Cerebellar calibration- learn the error at each azimuth)

Different environments-> different errors

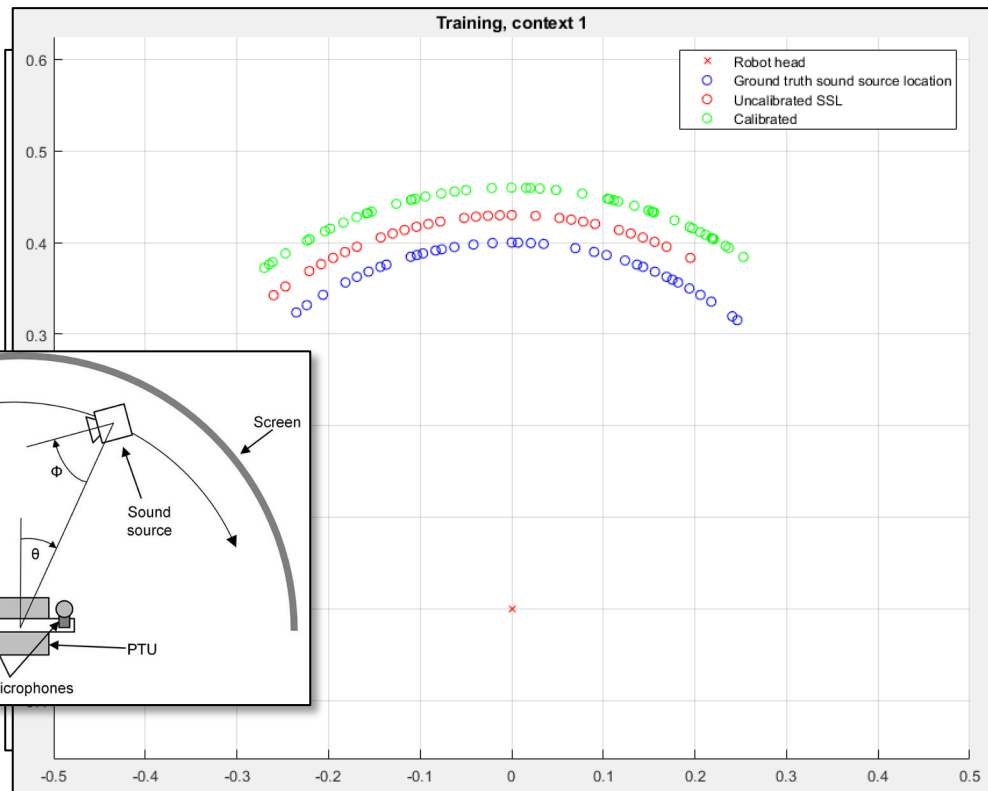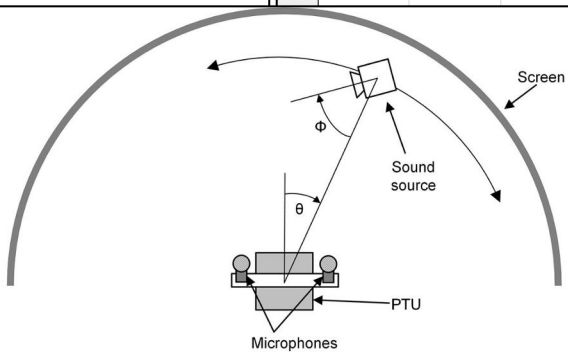(multiple models)
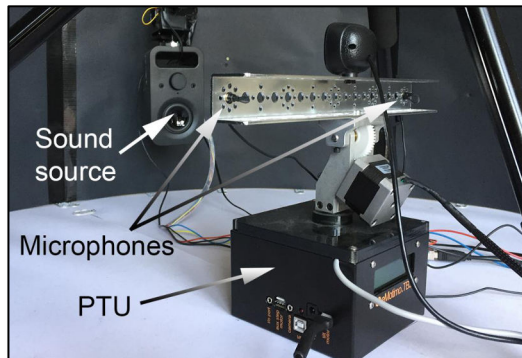
SSL calibration

SSL algorithm generates estimate (with error)

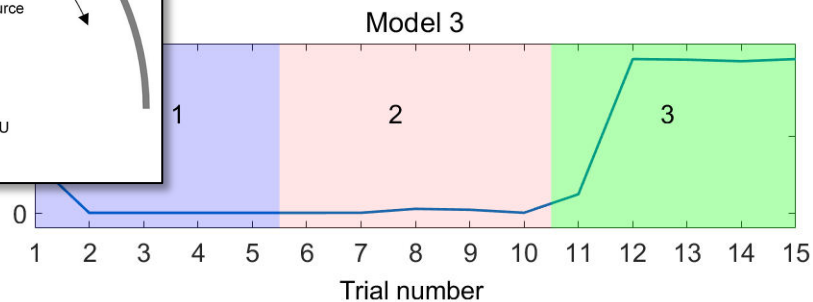Adaptive filter model of the cerebellum learns error in azimuth estimate
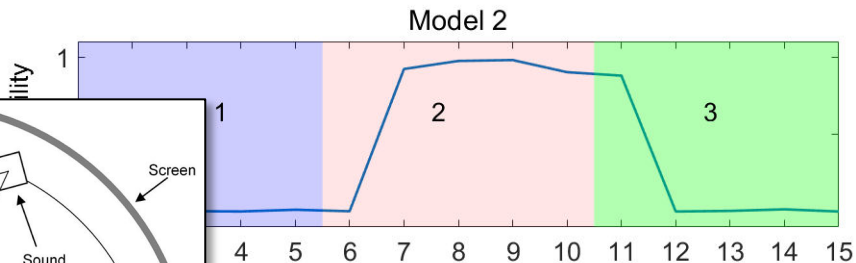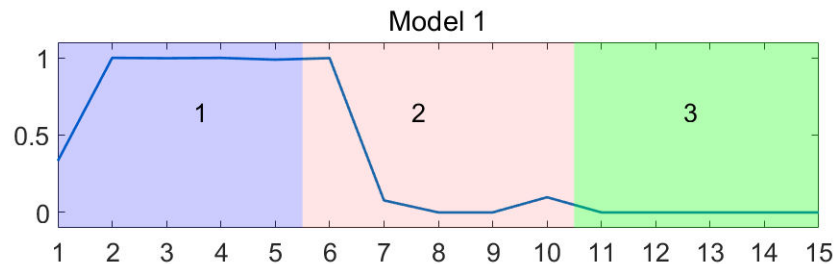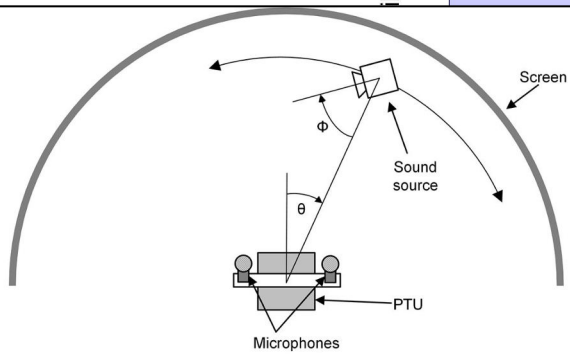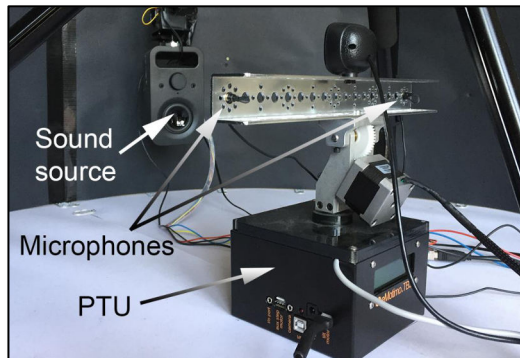
SSL calibration

Parallel fibres encode activity at each azimuth

Responsibility signals

3 different acoustic contexts

RE determines responsibility
based on feedback after action

Bibliography

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