

# Active Inference Sensory Attenuation illusion

September 16, 2020

## 1 ActiveInferenceSensoryAttenuationIllusions

Implementation of the model described in :

*Active inference, sensory attenuation and illusions.* Brown, H., Adams, R. A., Parees, I., Edwards, M., & Friston, K. (2013). Cognitive Processing, 14(4), 411–427. <https://doi.org/10.1007/s10339-013-0571-3>

### Generative Process

$$\begin{aligned} \mathbf{s} &= \begin{bmatrix} s_p \\ s_s \end{bmatrix} = \begin{bmatrix} x_i \\ x_i + v_e \end{bmatrix} + \boldsymbol{\omega}_s \\ \dot{\mathbf{x}} &= \dot{x}_i = \sigma \alpha \frac{1}{4} x_i + \omega_x \\ \boldsymbol{\omega}_s &\sim \mathcal{N}(\mathbf{0}, e^{-8} \mathbf{I}) \\ \omega_x &\sim \mathcal{N}(0, e^{-8}) \end{aligned}$$

### Generative Model

$$\begin{aligned} \mathbf{s} &= \begin{bmatrix} s_p \\ s_s \end{bmatrix} = \begin{bmatrix} x_i \\ x_i + x_e \end{bmatrix} + \boldsymbol{\omega}_s \\ \dot{\mathbf{x}} &= \begin{bmatrix} \dot{x}_i \\ \dot{x}_e \end{bmatrix} = \begin{bmatrix} \nu_i - \frac{1}{4} x_i \\ \nu_e - \frac{1}{4} x_e \end{bmatrix} + \boldsymbol{\omega}_x \\ \boldsymbol{\nu} &= \begin{bmatrix} \nu_i \\ \nu_e \end{bmatrix} + \boldsymbol{\omega}_\nu \\ \boldsymbol{\omega}_s &\sim \mathcal{N}(\mathbf{0}, e^{-\pi} \mathbf{I}) \\ \boldsymbol{\omega}_x &\sim \mathcal{N}(\mathbf{0}, e^{-4} \mathbf{I}) \\ \boldsymbol{\omega}_\nu &\sim \mathcal{N}(\mathbf{0}, e^{-6} \mathbf{I}) \\ \pi &= 8 - \gamma \sigma (x_i + \nu_i) \end{aligned}$$

### Variational Laplace Encoded Free Energy

$$\begin{aligned} F &= -\log(P(s, \boldsymbol{\mu}_x, \boldsymbol{\mu}_\nu)) + C \\ &= -\log(P(s|\boldsymbol{\mu}_x)P(\dot{\boldsymbol{\mu}}_x|\boldsymbol{\mu}_x, \boldsymbol{\mu}_\nu)P(\dot{\boldsymbol{\mu}}_\nu|\boldsymbol{\mu}_\nu)) + C \\ &= -\log(\mathcal{N}(g(\boldsymbol{\mu}_x), e^{-\pi} \mathbf{I})\mathcal{N}(f(\boldsymbol{\mu}_x, \boldsymbol{\mu}_\nu), e^{-4} \mathbf{I})\mathcal{N}(\boldsymbol{\mu}_\nu, e^{-6} \mathbf{I})) + C \end{aligned}$$