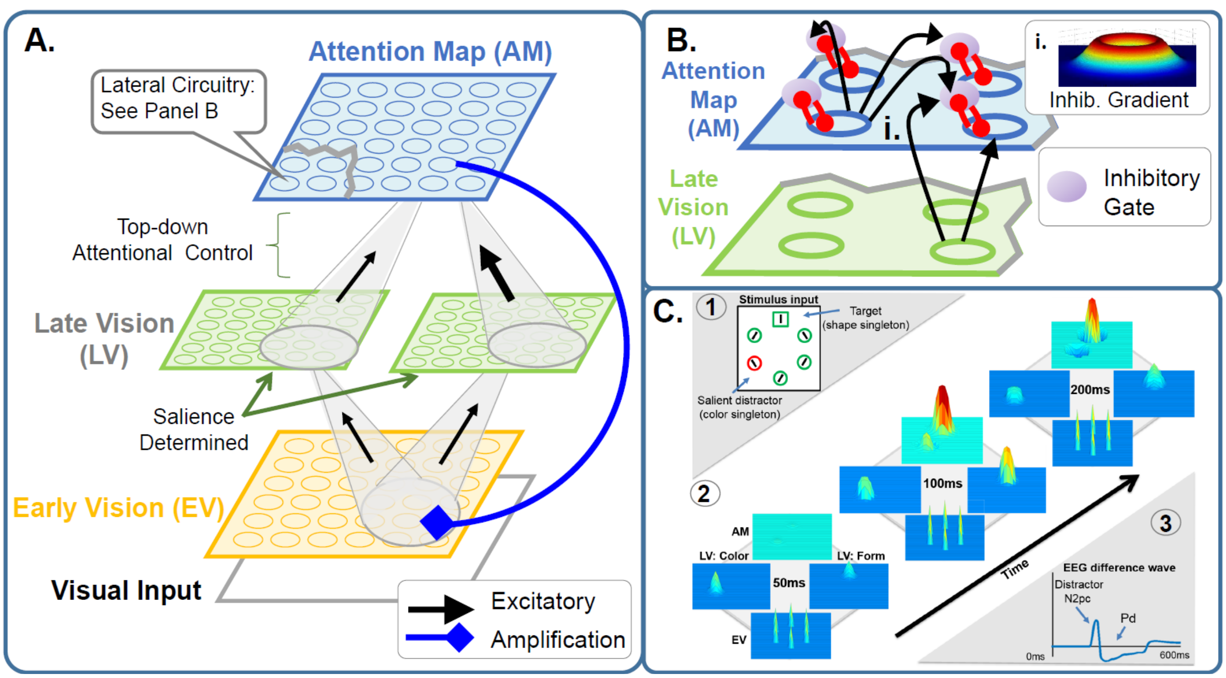
The Reactive-Convergent Gradient Field model (R-CGF) is a unique approach to modeling spatial attention in that it links neural mechanisms to event related potentials (ERPs) from scalp EEG. This model was developed with the aim of explaining different, sometimes conflicting, findings in the attention literature. Specifically, this model addresses conflicting findings showing both simultaneous[i] and serial[ii] deployment of attention. Another argument addressed by the model is whether attention to a location invokes a suppression of the spatial surround[iii], or the selective inhibition of distractors[iv]. With the R-CGF, we have found that these results are not as incompatible as they appear but rather can both result from a common set of mechanisms in different kinds of experiments.

The model has three main neural sheets, early vision (EV), late vision (LV) and a master attention map (AM), connected spatiotopically. The LV layers are specialized for different features (e.g. shape or color) with modulated connections to the AM depending on task requirements. The AM implements a reactive inhibitory circuit through gating neurons that suppresses attention selectively at the location of distractors that are proximal to the target. The model uses the Euler's method to solve series of differential equations in conjunction with the O'Reilly and Munakata (2000) equations to provide distinct excitatory, inhibitory and leak currents for each neural units:

$$M_{i,j,t} = M_{i,j,t-1} + dtVM \times \left[\left(Bias_j + Excite_{i,j,t-1}\right) \times \left(EE_j - M_{i,j,t-1}\right) + Inhib_{i,j,t-1} \times \left(EI_j - M_{i,j,t-1}\right) + Leak_j \times \left(EL_j - M_{i,j,t-1}\right)\right]$$

Where *M* is the membrane potential a given location (*i,j*) at time step *j*.



A) The R-CGF model. Slabs correspond to spatiotopic maps of neurons. LV maps represent distinct maps (e.g. form, color). Attentional control weights the outputs of LV to AM. Strongly active neurons in the AM enhance output of EV at the corresponding location. **B)** The reactive inhibition circuitry in the AM and LV. Inhibitory gate neurons need convergent lateral and bottom-up excitation to activate, which causes inhibition to be selectively targeted. Inhibitory links to gate neurons allow AM neurons to block their inhibition which permits multiple foci of attention. i. Spatial topography of lateral projections to the inhibitory gate neurons within AM is modeled as a difference of Gaussians. **C)** Simulated dynamics of activity in response to an attentional capture display (1) leading to inhibition of attention at distractor location (2). For clarity, left/right hemifields are not switched. (3) Simulated ERP produced by the above simulation.

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