Dynamics of an SIS-like audience applause model

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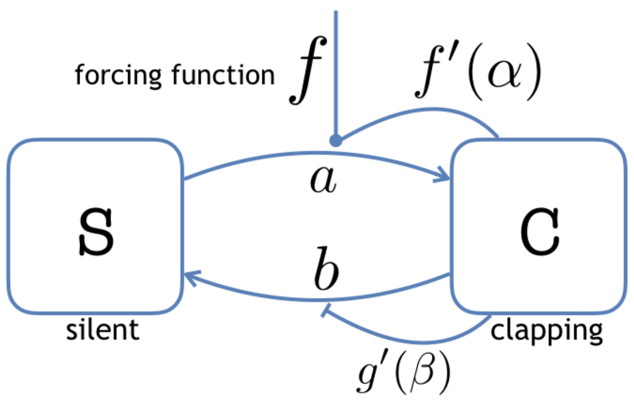
The Compartmental Model



The compartmental model of audience applause based on the SIS epidemic model.

States, parameters, and functions

Agents transition between states S and C with probabilities a and b.

$$\mathrm{R}_1 \;:\; \mathrm{S} \longrightarrow \mathrm{C} \tag{1}$$

$$\mathrm{R}_2 \;:\; \mathrm{C} \longrightarrow \mathrm{S} \tag{2}$$

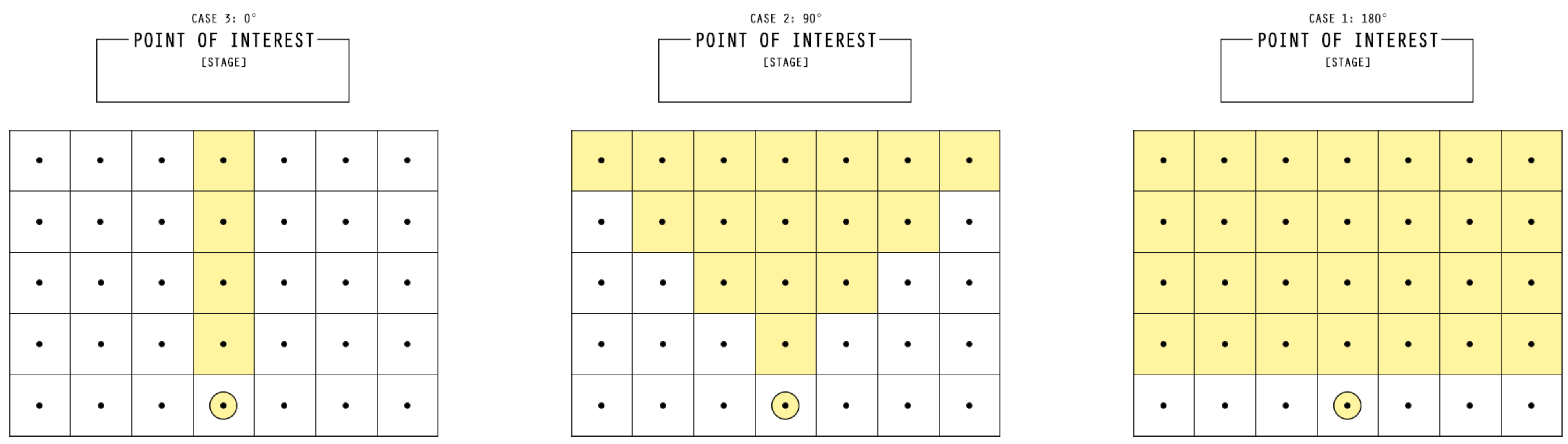
f is a function that forces the transition R_1.
f'(α) is a feedback function the encourages R_1 depending on the fraction of agents in state C.

$$f'(\alpha) = \alpha \frac{n_c}{N-1}, \tag{3}$$

$g'(\beta)$ is a modulation function that inhibits R_2 taken from the michaelis-menten equation

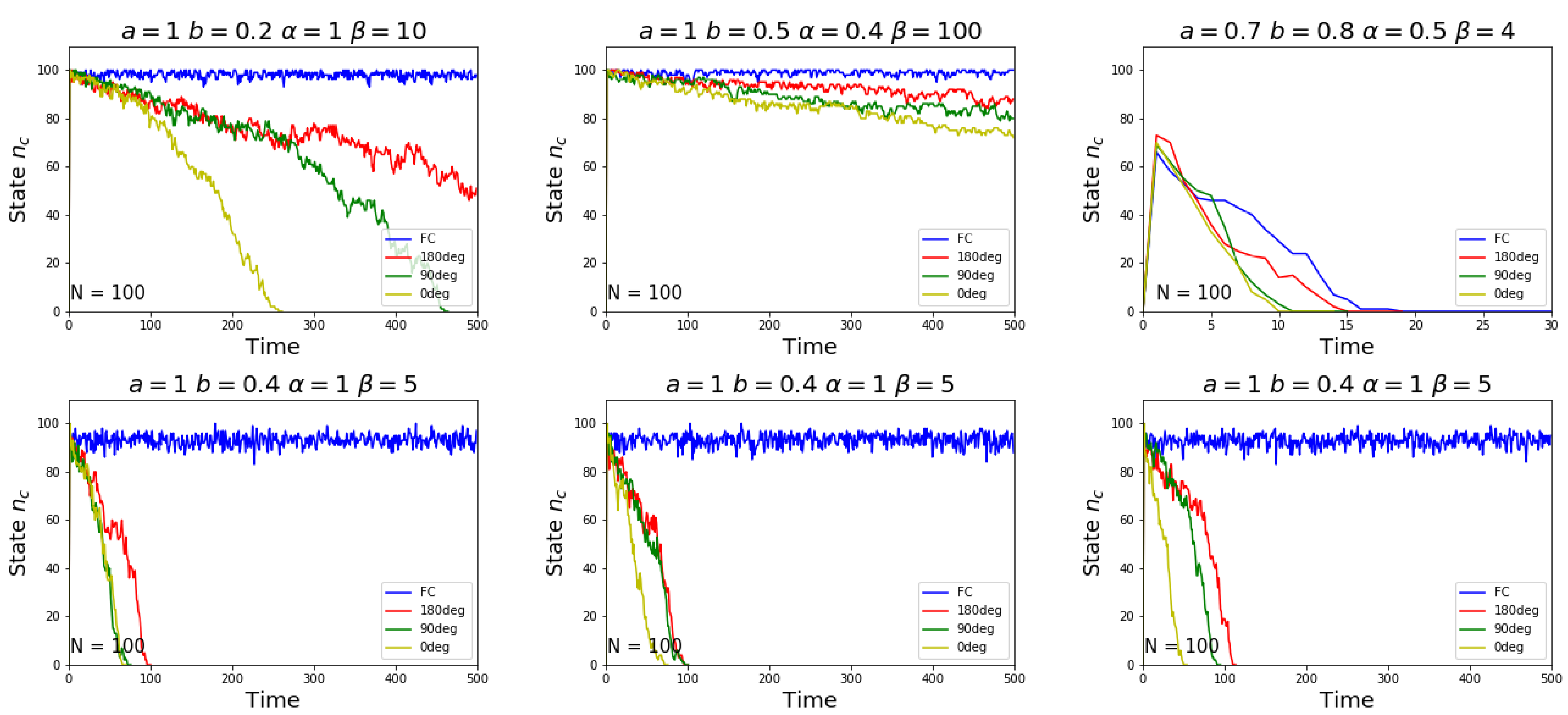
$$g'(\beta) = \frac{1}{1 + \beta\, n_C/(N-1)} \tag{4}$$

Incorporating spatial effects



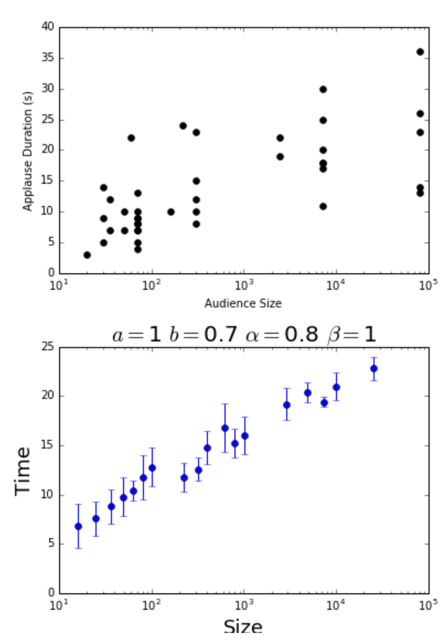
The original feedback function $f'(\alpha)$ would consider every other member of the audience. Incorporating spatial effects limits the influence of the audience to the field of view of the reference agent. Shown are configurations of $\theta = 0, \frac{\pi}{2}$, and π. The original feedback function is considered to have a configuration of $\theta = 2\pi$

Comparing Spatial Configurations



Shown are simulations with varying (a, b, α, β) parameters. Configurations $\theta = 0, \frac{\pi}{2}, \pi$ all have trivial steady-states. $\theta = \pi$ will always have a greater applause duration than $\theta = 0$, while $\theta = \frac{\pi}{2}$ varies between the two. $\theta = \pi$ is used hereafter as it is the most realistic and code efficient.

Finding the parameters (a, b, α, β) for real-life applause



Simulations using the $\theta = \pi$ configuration were run for various audience population sizes. The applause duration was then plotted against the audience size to be compared with a data set of real-life applause. One of the best fit parameters are $(1, 0.7, 0.8, 1)$.

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