

PSYCH 216 Psychology of Learning and Memory, Prof. Choi, June-Seek
Homework Assignment

Computational Exercise: Simulated learning using Rescorla-Wagner Model

$$\Delta V_i = \alpha_i \beta_k (\lambda - \Sigma V_i)$$
$$V_{t+1} = V_t + \Delta V_i$$

Where ΔV_i = change in associative strength of the CS i ; α_i = saliency of the CS i ; β_k = learning rate for the US k ; λ = strength of the US; ΣV_i = sum of associative strength of all the CSs present on a given trial.

General instruction

- Use Microsoft Excel or any other spreadsheet program to do the computation (Or you can write a simple program to do the simulation using any programming language including Python. In any case, plot your simulation results in a graph)
- Submit through Blackboard according to the instructions posted on the same board. Your submission should include at least one graph showing the main simulation result and your interpretation of the result (*for example*, was the result what you expected? Was the result surprising? Why/why not?)
- All the graphs must be labeled properly and show all the scales.
- For all problems, use initial value of $V = 0$; learning rate $\beta = 0.1$ when the US is present or $\beta = 0.05$ otherwise ; US strength $\lambda = 1$ when the US is present unless otherwise specified or $\lambda = 0$ when the US is **NOT** present. .

Problem 1: Conditioned inhibition (1 points)

1. Two alternating trial types: trial 1: CS1+; trial 2: CS1/CS2-; 100 trials total
2. Plot both CS1 and CS2 in the same graph
3. Saliency: CS1:0.7; CS2: 0.7

Problem 2: Overexpectation (2 points)

1. Stage 1. group 1: CS1+, group 2: CS1+, 100 trials
2. Stage 2. group 1: CS2+, group 2: CS2 +, 100 trials
3. Stage 3. group 1: CS1/CS2+, group 2: Sit, 100 trials
4. Stage 4. group 1: CS1/CS2-, group 2: CS1/CS2-, 10 trials
5. Plot stage 1~4. Plot both individual and combined CSs for stage 3~4.
6. Saliency: CS1: 0.7 CS2: 0.7

Problem 3: Second-order conditioning (1 points)

1. CS1+, 100 trials
2. CS1/CS2-, 25 trials
3. CS2-, 10 trials
4. Saliency: CS1=CS2: 0.7

Problem 4: Sensory preconditioning (2 points)

1. Stage 1: CS1/CS2-, 100 trials
2. Stage 2: CS2+, 100 trials
3. Stage 3: CS1-, 10 trials
4. Saliency: CS1: 0.7 CS2: 0.3

Problem 5: Supernormal conditioning (2 points)

1. Assume the initial value of CS2 = -0.8
2. Stage 1: CS1/CS2+, 100 trials
3. Stage 2: CS1-, 10 trials
4. Stage 3: CS2-, 10 trials
5. Saliency: CS1=CS2: 0.7

Problem 6: Excitatory conditioning without the US (2 points)

1. Assume the initial value of CS2 = -0.8
2. Stage 1: CS1/CS2-, 25 trials
3. Stage 2: CS1-, 10 trials
4. Stage 3: CS2-, 10 trials
5. Saliency: CS1=CS2: 0.7

Optional question (2 points):

Simulate a conditioning case where the US is presented sometimes in the absence and sometimes in the presence of the CS, by assuming the context as a CS using R-W model. You can use your own parameters within the range specified by the R-W model. Using several different sets will give you a nice set of data to plot in a graph. You can also try different sets of $p(\text{US/no CS})$ and $p(\text{US/CS})$. What did you find from the simulation?