Prof. Dr. G. Schöner, Institut für Neuroinformatik   gregor.schoener@rub.de

November 2, 2016

Essay exercise (worth 3 exercise sheets), due November 17, 2016

In response to each question, write a self-contained text that can be read without having read the question. Make sure you deliver to the reader all information necessary to appreciate the point you are making. Take the reader step by step through your argument. Use illustrations that you label and explain so that they can be understood without going back to the source. Finish each point with a short conclusion.

Do not quote literally from sources, and indicate the source of illustrations.

A typical volume of the essay is about 10 pages, but the size varies with how concise you are. Given the same contents, shorter is better.

If several of you collaborate, each must deliver his or her own text. Identical formulation of pieces of the essay is considered fraudulous.

Read the Chapter 1 "Neural Dynamics" by Gregor Schöner, Hendrik Reimann, and Jonas Lins. (Top entry in list of downloadable documents on course webpage).

1. Around Figure 1.12 explain how input (a "stimulus") is formally represented in neural dynamics. Describe how presenting a stimulus to the sensory surface affects the temporal evolution of neural activation. Use your own words and develop your own illustrations! Also discuss and illustrate what happens when an input/stimulus is removed again. Vary the length of presentation of a stimulus and think through and illustrate what will happen then to neural activation. Is there a minimum length of presentation needed to get any positive activation?

2. Based on what you learn about inhibitory coupling among activation variables around Figure 1.19, make a thought experiment for this two-neuron network. That is, describe the stable activation patterns that are possible in response to the set of 4 input patterns in which inputs s_1 and s_2 take on all combinations of values of 0 or 1. Assume that an input of 1 is strong enough to push an activation variable above threshold if there is no inhibition from the other neuron, but not, if there is inhibition from the other neuron. In each case, you will need to step through 4 cases of initial conditions for the two neurons, in which either neuron can be below or above threshold before the stimulus is applied. You could use tables or other ways of illustrating this (e.g., you can use the four quadrants of a two-dimensional coordinate frame that spans activations u_1 and u_2).

3. Write down in one paragraph at least one point that you now understood better than in the lectures.

4. Formulate at least one question you have about the Chapter. Can be a question of clarification, of generalization, of criticism.