connections to the fields. The node activations relevant for this exercise are all shown in the top left plot. Activation levels for the ordinal nodes are plotted as blue dots, activations for the corresponding memory nodes as red dots. The go signal and the activation of the CoS node are shown as black dots.

a) Start the sequence by pressing the `Go` button. The go signal that is created sets an external input to the first memory node. (Note that the first pair of ordinal/memory nodes serves only for the stable initiation of the sequence. The first ordinal is never activated and therefore cannot create any behavior here.) What do you observe? Wait a few moments, until the second ordinal node is activated, then inactivate the go signal by clicking the button again. What happened when you turned off the go signal? Why is the state of the ordinal nodes different from the initial state after the transient activation of the go signal?

b) Create sequential transitions by manually activating the CoS node, using the slider `i _ cos`. Provide sufficient input to bring the node into the on-state, thus suppressing the ordinal nodes, then turn the input off again and observe the next ordinal become active. Observe what happens when you change the timing of this manipulation. You may reset the ordinal dynamics by briefly de-boosting all nodes in the ordinal dynamics (toggle the button `De-boost nodes` on and then off again), and then start the sequence again by briefly activating the go signal.

Exercise 2: Linking to Behavior and Learning and Sequences

This exercise will demonstrate the coupling of the ordinal dynamics to an intention field and a condition-of-satisfaction field (shown in the two bottom plots in the GUI) to replace the manual transition between steps used in the first exercise. A manual input is still needed to create the transition to the next step, but this input now reflects a sensory signal indicating the completion of some elementary behavior. Moreover, the exercise shows how different intentions can be associated with the ordinal nodes to generate a sequence of different behaviors.

Before you start this exercise, reset the ordinal dynamics by briefly de-boosting the ordinal and

EXERCISES FOR CHAPTER 14

The exercises will help you understand the switching dynamics in the sequence generation architecture. In order to start the simulation for this exercise, run the file `launcherOrdinalDynamics`.

Exercise 1: Dynamics of Sequential Switching in the Ordinal Set

This exercise will focus on the dynamics of the ordinal nodes and memory nodes, and not use the

memory nodes. The input to the CoS node `i_cos` should be set to zero.

a) Click the button `Learn` to activate the weight adaption from ordinal nodes to intention field, then start the sequence by briefly activating the go signal. The second ordinal node should become active. Now induce a peak in the intention field by increasing the stimulus amplitude `a_int` to 6. In the plot at the top right, you should now see the adaption of the connection weights from the second ordinal node to the active region in the intention field. What else do you observe?

b) The amplitude of the input to the CoS field, `a_cos`, should be set to 3. Move this input so that it overlaps with the intention field input, using slider `p_cos`. What happens in the CoS field? What effect does this have on the nodes of the ordinal dynamics?

c) Move the input to the intention field to a new position using the slider `p_int`. This position in feature space will be associated with the third ordinal node. Observe the effects of moving the intention field input on the CoS field and the ordinal nodes. Also observe how new weights are learned for the next ordinal node.

d) After the connection weights for the current ordinal node have saturated, repeat the above steps for the remaining nodes: Move the external input to the CoS field so that it matches the location of the intention field input, producing a peak in the CoS field and terminating the current step. Then move the intention field input to a new location for the next node.

e) After connections have been learned for all nodes, turn off the learning by clicking the button `Learn` again. Turn off the external input to the intention field (set `a_int` to zero), and reset the ordinal dynamics by briefly de-boosting the nodes. Now start the ordinal dynamics again by briefly activating the go signal. Observe how the system induces a peak in the intention field. To induce the transition to the next step, move the input in the CoS field to match the peak in the intention field. As in the first exercise, you can vary the timing of this action; to simulate varying times it takes an agent to complete a behavior.